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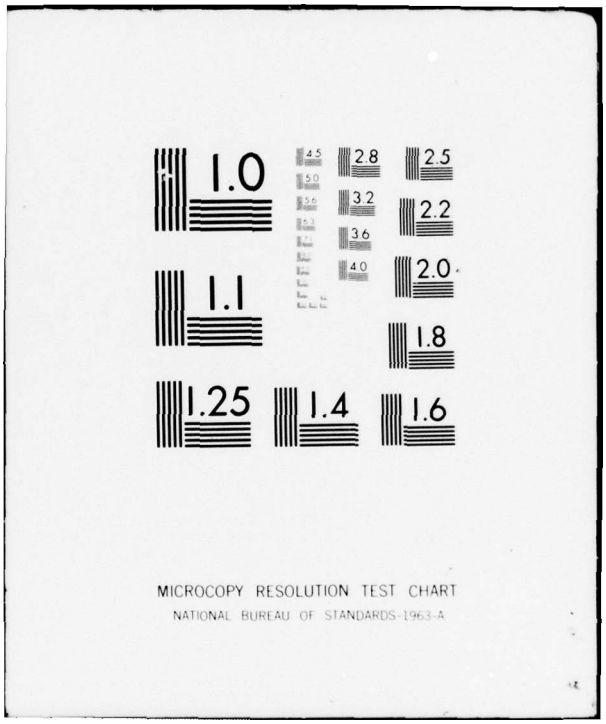
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VOLUME VII

OHIO RIVER BASIN

COMPREHENSIVE SURVEY

Appendix F

AGRICULTURE

Prepared by
Soil Conservation Service, Economic Research Service, and Forest Service, U.S. Department of Agriculture in cooperation with Departments of Army; Commerce; Health, Education and Welfare; Interior; the Federal Power Commission and participating states.

U.S. ARMY ENGINEER DIVISION, OHIO RIVER-CINCINNATI, OHIO

OHIO RIVER BASIN
COMPREHENSIVE SURVEY

Volume VII.

APPENDIX-F.

AGRICULTURE.

THIS CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE

PREPARED BY

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

ECONOMIC RESEARCH SERVICE

FOREST SERVICE

12 173 p.

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UNITED STATES DEPARTMENT OF AGRICULTURE
Field Advisory Committee, Ohio River Basin

Soil Conservation Service
Forest Service
Economic Research Service

This Appendix contains an appraisal of needs, problems and potential solutions of water and related land resource developments in the upstream watersheds in the Ohio River Basin. It also includes an appraisal of the current and projected agriculture and forest economy, related developments and determination of land requirements.

The report presents information obtained from cooperative investigations by the Soil Conservation Service, the Forest Service and the Economic Research Service of the U. S. Department of Agriculture. Coordination of the study among the three agencies involved is in accordance with an Inter-Agency Memorandum of Understanding. It is an integral part of the Ohio River Basin Comprehensive Survey.

Kenneth E. Grant
State Conservationist
Soil Conservation Service
Chairman, USDA Field Advisory Committee

ACKNOWLEDGEMENT

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Photographs appearing in this report were supplied by the Forest Service and the Soil Conservation Service.

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I - SUMMARY

The agricultural resources are potentially adequate to satisfy projected needs for food and fiber within the Basin, as well as its portion of the national demand. Resource development will be increasingly necessary after about 2000. However, in the interim, resource development is needed to increase efficiency of the agricultural industry and to help stabilize the income of farm families and dependent communities. Full development of water and related land resources will be needed by 2020 to meet the projected consumption of agricultural products.

Many opportunities for satisfying water and related land resource needs exist throughout the study area. In upstream areas there are about 600 potentially feasible watershed projects totalling about 37.9 million acres or 36.3% of the Basin. These will include appropriate land treatment measures, and about 2,900 floodwater retarding structures and 6,300 miles of channel improvements. They would protect about 1.9 million acres of flood plain land and reduce the average annual floodwater damage of $53.1 million to $22.3 million or about 60%.

Most of the subbasins have high potential for watershed development. Preliminary studies indicate that potential projects could alleviate present upstream flood damages by more than 70 percent in the Salt and Licking Subbasins; from 60 to 70 percent in the Muskingum, Scioto, Little Miami, Great Miami, Kentucky, Green and Wabash; from 50 to 60 percent in the Allegheny and Cumberland; from 40 to 50 percent in the Monongahela, Kanawha, Guyandotte and Big Sandy; from 30 to 40 percent in the Beaver; and less than 30 percent in the Little Kanawha and Hocking.

In addition to reducing floodwater damages in upstream projects the combination of land treatment measures and floodwater retarding structures would have varying effects on peak discharges and sedimentation in downstream reaches. The relationship of peak discharge and sediment damage reductions in downstream areas is generally in the same proportion as the area controlled by upstream structures. Subbasin control by potential project structures varies from a high of 18 percent in the Kentucky to 2 percent in the Little Kanawha. (See Table 44.)

The potential watershed projects offer opportunities for development to help meet needs for functions other than flood control. Good possibilities for the satisfaction of needs for recreation, fish and wildlife, irrigation, rural community, municipal and industrial water supply, and water quality control exist in most of the subbasins. These needs may be met either in conjunction with flood prevention storages, other multiple purpose developments, or in single purpose structures. Preliminary studies reveal that up to 237,000 surface acres of water could be developed for either fish and wildlife or recreation purposes or a combination thereof. In addition to the necessary detention for flood prevention, about 1.0 million acre feet of water storage could be made available for either water supply, water quality control, irrigation water supply or combinations thereof.

Damages in upstream areas outside of potential watershed projects vary widely from one subbasin to another. The Wabash has the highest with $3,800,000 average annual damages, while the Salt has the least, $13,000. Land treatment measures and management practices are the only means of flood damage reduction in upstream areas where structural control is not feasible. Land treatment measures generally applied for on-farm benefits also have beneficial off-site effects. Well managed lands of good forest or other vegetative cover not only break up and lessen the detrimental erosive forces of rainstorms, but also reduce peak discharges from the more frequent storms which in turn reduces sediment deposition in downstream areas. As much as 5 to 10 percent reduction in average annual flood damages have been realized from on-farm measures when applied throughout upstream watersheds. Reductions of from 10 to 30 percent in sediment deposition in well treated watersheds can be expected. Another significant benefit of land treatment measures is the extension of the useful life of downstream reservoirs, navigation facilities and stream channel improvements through sediment reduction.

About 40 percent of the Basin is forested, mostly privately owned. Many watersheds in the eastern part are more than 80 percent forested. Close cooperation by industries, farmers and other private owners, as well as public agencies, can materially aid in the solution of the problem of satisfying demands for goods and services from forest land. The only solution to good land resource conditions on much of the forested land is through enlightment and the development of interest on the part of small tract forest owners. Strengthened State forestry organizations to provide technical assistance to these owners are needed.

Public lands afford opportunities for partial solution to the problem of meeting demands for water and related land. As a minimum, additional lands should be acquired to increase surface water from 5,000 to 77,000 acres and closely related land from 7,800 to 55,000 acres within the National Forests by 2020 for recreation.

Private on-farm developments will continue to provide opportunities for the satisfaction of many of the Basin's needs for water and related land resources. Rural domestic and livestock water supplies generally are developed from ground or surface water sources through the use of springs, wells, streams or small surface impoundments. This resource appears to be adequate to meet future needs. However, an active program is required to reduce water pollution and contamination and thereby insure the yield of high quality water.

The opportunity to fulfill many of the Basin's needs for outdoor recreation, including fish and wildlife, exists on private lands. Water and land area developments, whether for commerical or private family use, significantly contribute to the recreation needs of many people. In recent years there has been a noteworthy trend toward the development of these enterprises. This is expected to increase as the need and pressure increases.

Approximately 6 million acres of agricultural lands need drainage in the Basin. Efficiency of farm operations and the economic demand for

food and fiber are the prime determinants in land drainage development. Farm owners are expected to continue the practice of drainage improvements in their normal operations. Flood prevention project developments, through the provision of major outlets and the reduction of damaging overflows, will provide incentives for drainage developments. Drainage of 4 million acres by 1980 is economically justified in terms of improved production efficiency. Likewise, an additional 0.5 million acres are expected by 2000, and an additional 0.8 million acres by 2020.

Irrigation water is presently being applied on about 50,000 acres of which 30,000 acres are in specialty crops. As the demand for food and fiber increases the economic potential for agricultural irrigation is expected to increase to 215,000 acres by 1980, to 774,000 acres by 2000, and to 1,419,000 acres by 2020. As in the case of present operations, future irrigation water is expected to be supplemental to normal rainfall patterns and distribution. Field crops will gain prominence in the overall irrigation picture with 1,244,000 acres being irrigated by 2020. The predominately agricultural areas; Muskingum, Scioto, Ohio-Cincinnati, Little Miami-Great Miami, Licking-Kentucky-Salt, White, and Wabash Subareas; contain most of the lands expected to be irrigated. Water requirements for irrigation show increases in proportion to acreage increases.

Agriculture, and forestry are main elements of the region's economy and contribute to natural beauty and general quality of the environment. While progress has been made in private on-farm development, in National Forest programs, and in upstream watershed projects, much remains to be done to meet future demands.

II - INTRODUCTION

This report, by the U. S. Department of Agriculture, is an integral part of the "Comprehensive Survey of Water and Related Land Resources in the Ohio River Basin," (Type I). The basic objective of the survey is to provide a broad guide for the best combination of uses of water and related land resources to meet foreseeable short and long-term needs. This U.S.D.A. study provides the guide for agricultural, rural and upstream areas. It was developed through close cooperation with other Federal, State, and local agencies.

In its 1950 report, the President's Water Resources Policy Commission urged the development of regional plans in the following words:

> "The Nation should have comprehensive multiple-purpose and coordinated plans for each of the regions (major river basins or groups of basins). Such a plan need not initially be in complete detail, but it should constitute a framework into which can be fitted, in proper relation to all other activities, the projects and programs as they are further developed."

Then in 1961, the Senate Select Committee recommended the preparation of "plans for comprehensive water development and management for all major river basins in the United States." Senate Document No. 97 (87th Congress, May 1962) "Policies, Standards and Procedures in the Formulation, Evaluation and Review of Plans for Use and Development of Water and Related Land Resources" gave further emphasis to coordinated comprehensive river basin planning. The Water Resources Planning Act of July 22, 1965 established the Water Resources Council as a statutory body for continuing guidance in river basin studies.

Purpose and Scope

The purpose of this report is to appraise overall problems and needs of water and related land resources and the potentials for development in the Ohio River Basin.

The water problems analyzed include (1) floodwater and sediment damage to crops, rural lands and urban areas; (2) impaired drainage of agricultural lands; (3) agricultural drought problems and irrigation requirements; and (4) water needs for livestock, rural domestic use, recreation, fish and wildlife, and forest based industries. Inventories and analyses of potential water and related land resource developments in upstream watersheds, including storage and cost estimates are presented for subbasins.

The report includes projections for the years 1980, 2000 and 2020, based on expected population growth and economic development. The projections are for agriculture output, timber production, and land use - including strip mines, land treatment, and employment. These projections are shown for the entire Basin and for each of the economic

→ next page

cont → subareas.

The report translates the analyses of the economic projections into needs for water and related land resources. Water supply and quality as well as the availability of related land resources are discussed in the section on present status of water resource developments. Unsatisfied needs and problems with their possible solutions are shown for the current, 1980, 2000, and 2020 time periods.

Authority

This study was made under the Authority of Section 6 of the Watershed Protection and Flood Prevention Act of the 83rd Congress (Public Law 566, as amended). This law authorized the Secretary of Agriculture to cooperate with other Federal, State, and local agencies in their investigations of watersheds, rivers, and other waterways to develop coordinated programs.

The initial written request for U.S.D.A. to participate in a framework plan for the Ohio River Basin was submitted by the Secretary of the Army to the Secretary of Agriculture on June 21, 1962. The Secretary of Agriculture's reply of Nov. 27, 1962, assigned general responsibility for the U.S.D.A. surveys and investigations to the Soil Conservation Service.

Location and Delineation of Study Areas

The Ohio River Basin Survey includes all of the drainage area of the Ohio River and its tributaries, or about 5 percent of the Continental United States. The Tennessee River Basin was not included in the study. The Basin covers about 163,000 square miles, and includes most of Indiana, Kentucky, Ohio, and West Virginia; substantial parts of Illinois, Pennsylvania, and Tennessee; and small areas of Maryland, New York, North Carolina, and Virginia. The Basin is bounded on the north by the Great Lakes drainage; on the east by the drainage to the Atlantic Ocean; on the south by the Tennessee River Basin, and on the west by the Mississippi River drainage.

Two systems for delineating subparts of the Basin were used to develop data for the report. In determining the upstream flood damages and water resource developments, the study area was divided into 18 hydrologic subbasins and Ohio Minor Tributaries as used in Appendix M - Flood Control, "Ohio River Basin Comprehensive Survey." These delineations are shown on Plate 1. Development of demands and needs for livestock and rural domestic water, irrigation, drainage, land use and production, National Forest and timber resources, and employment were determined on the basis of the 19 subareas as delineated in the Projective Economic Study (Appendix B, "Ohio River Basin Comprehensive Survey") with subsequent modifications. These subareas are named for the principal tributaries whose drainage basin they approximate. (See Plate 2.)

Participants

The principal U.S.D.A. participants were the Soil Conservation Service, the Forest Service and the Economic Research Service. This coordinated study within the Department is in accordance with the Memorandum of Understanding dated Feb. 2, 1956, among the heads of the three agencies.

III - GENERAL DESCRIPTION OF THE AGRICULTURE RESOURCE BASE

Agriculture is one of the principal enterprises in the Ohio River Basin. In addition to satisfying local needs for food, fiber and forest products; the agricultural resource contributes significantly to national requirements and foreign exports.

Generally the climate, topography and soils are favorable to agricultural and forest production. However, wide variations exist throughout the Basin and have marked effects on this development.

Climate

The Basin lies wholly within the humid eastern United States and is considered to have a climatic water surplus. The weather systems usually move from west to east. However, the area is also influenced by masses of cold polar air from the north and warm tropical air from the south. Either system may move in at any time of the year with the accompanying effects of chilling or warming. Spring and summer thunderstorms with intense rains of short duration are common. The variance in temperature and precipitation from year to year and among the subareas affects agricultural production significantly.

Summer temperatures vary throughout the Basin and are influenced in part by differences in elevation. The average July temperature is around 75°F. Winters are fairly cold with several days of subzero weather annually. Minimum recorded temperatures have been near 30° below zero F. The annual variations in temperature for nine locations spaced throughout the Basin are shown in Plate 3 of Appendix C, Hydrology, Ohio River Basin Comprehensive Survey.

Last killing frosts in spring occur on the average from April 10, in the southernmost part of the Cumberland Subbasin in Tennessee, to May 30 in the headwaters of the Allegheny River in New York and Pennsylvania - the most northerly part. First frosts in fall occur on the average from September 30 in the Allegheny Subbasin to October 20 in the Cumberland Subbasin. Killing frosts have occurred as late as May 1 at Clarksville, Tenn., and June 12 at Franklin, Pa., and as early as August 13 at Franklin and October 2 at Clarksville.

Late killing frosts constitute a particular hazard to the production of row crops and to early blooming fruit trees. The average growing season varies from 120 days in the northeast part of the Basin to 200 days in the southern part. The longer growing season and warmer temperatures are conducive to the production of cotton and tobacco in the southern portion.

Annual precipitation including snowfall varies considerably from year to year over the Basin. Total precipitation increases from north to south; the average annual for the entire Basin is 44.8 inches. The average annual precipitation varies from 36 inches along the northern divide to 52 inches in the southwest to 56 inches in the southeast, and

to as much as 80 inches in isolated areas in the Allegheny Mountains.

The greatest average monthly precipitation usually occurs in July, and the minimum occurs in October, with some minor modifications due to elevation and location. Precipitation is generally sufficient for agricultural uses and for domestic water supplies. However, periodic droughts cause domestic water shortages in rural areas.

Droughts are usually spotty or local in nature and crops are seldom a total loss, but loss of income due to lower yields is common. The drought effects on production are usually more pronounced between July 1 and August 15. Widespread droughts occur on the average of once every 6 to 7 years. A more complete description of droughts is included in Appendix C, Hydrology, Ohio River Basin Comprehensive Survey.

Although it is the second largest watershed tributary to the Mississippi River, the Ohio River has the highest volume of flow.

The average annual runoff for major tributaries of the Ohio River Basin varies from 11 to 23 inches. In the Allegheny and Monongahela Subbasins this amounts to about 23 inches, or 60 percent of the average precipitation; whereas in the Wabash the runoff is 12.8 inches or about 31 percent. These differences are influenced by the basin-wide variation in rainfall, topography, vegetative cover and soil types. For the rainfall-runoff relationship, see Appendix C, Hydrology, Ohio River Basin Comprehensive Survey.

Although the precipitation is about evenly distributed throughout the year, runoff is highest during the winter and early spring months and lowest in late summer and fall.

The frequency and magnitude of floods in the Ohio River Basin vary from one location to another. Individual storms seldom cover the entire Basin. However, widespread flooding due to frontal-type storms with prolonged rainfall has occurred. Historically, this type of flood has usually come during the winter months--before the growing season. Nevertheless, large acreages of farmland on the main stem and larger tributaries are inundated.

Local thunderstorms with intense rains of short duration usually occur during the spring and summer. Flash floods occur on small streams and damage crops, pasture, and other property in the floodplain. Thunderstorms occur on an average of 30 to 50 days annually and cause most of the upstream flood problems.

Snowfalls may be heavy but are usually followed by thawing periods. However, heavy rains accompanied by snow melt have caused floods in the Basin.

Topography

The topography varies from flat and rolling plains to mountains. Physiographic provinces are the Central Lowland, which contains the glacial till plains of Illinois, Indiana, and Ohio; the Interior Low Plateaus, in the western portions of Tennessee and Kentucky; and the Appalachian Plateau, in parts of Tennessee, Kentucky, Ohio, Pennsylvania, New York, Maryland, West Virginia, and Virginia. The Valley and Ridge Province on the southeast limits of the Basin contains small portions of Tennessee, North Carolina, and Virginia.

The highest point (5,729 feet) is Mount Rogers in Virginia; while the lowest point (310 feet) is at Cairo, Illinois. The area north of the Ohio River is generally a glaciated plain of minor relief drained by meandering rivers flowing through wide, flat valley floors. Rough, unglaciated lands border the Ohio River from Pennsylvania through Illinois. Lands south of the river are relatively level in the lower reaches of the western tributaries but become increasingly rolling and rugged and heavily forested towards the eastern boundary.

Geology

The geology consists of three broad physiographic regions. The eastern part of the Basin lies on the Allegheny and Cumberland Plateau. The bedrock, of the Carboniferous Age, is generally level but locally is strongly folded and faulted to form ranges such as the Allegheny and Cumberland Mountains. The topography is rugged. Valleys are narrow; consequently, areas of flat tillable land are small. Opportunities to combine tracts of land into larger farm units are often limited.

The central and lower part of the Ohio River Basin lies within the Interior Low Plateau (also called Interior Lowlands). The bedrock is largely Paleozoic in age. The bedrock is generally level to gently dipping. The attitude of the bedrock is controlled broadly by three major regional bedrock structures: (1) the Illinois - western Kentucky Basin, (2) the Cincinnati Arch, and (3) the Nashville Dome. The soils are chiefly made up of limestone, supporting fertile areas such as the Bluegrass Region of Kentucky.

The Till Plains north of the Ohio River are underlain by bedrock similar to Interior Low Plateau. However, this area was covered with glaciers during the Pleistocene Age which left deposits of unconsolidated material called drift or till. The drift varies in thickness from a few feet to several hundred feet. The level to rolling glaciated areas in this region form some of the most productive farm land in the region and Nation 1/.

1/ For a discussion of the geology of the area, see Lobeck, A. K. Geomorphology, McGraw Hill Book Co., Inc., New York, pp. 526-27.

Land Resources

Topographic and soil conditions have significantly influenced the Basin's agricultural development. The flatter and more gently sloping areas of deep fertile soils are well suited to row crop and pasture production. Conditions are favorable for efficient and high production. Half of the total land areas of the Basin is in cropland and pasture. Steep hills with shallow and highly erosive soils have limited the use of much of the Basin for crops and pasture. Only the usually narrow valley portions of these areas are suited to this use, and woodlands predominate. Plate 3 shows generalized agricultural land use of the Basin.

Major land uses in the Basin are:

	Acres (in 1,000)	Percent
Cropland	34,215	33
Pasture	16,350	15
Woodland	40,789	39
Urban & Built-Up	4,915	5
Other miscellaneous 1/	7,012	7
Water areas	1,140	1
Total	104,421	100

SOURCE: Table 10

About 40 percent of the Basin's total land area is forested. In the eastern part, some areas have more than 80 percent in forest. The western areas are less wooded and areas generally north of the Ohio River have as little as 10 percent forested. Mixed oaks, hickories, tulip poplar, walnut, hard maple, and other hardwoods cover the ridges and slopes. Some softwoods, primarily pine, are found in mixed stands or small pure stands. Bottomland hardwoods grow along the streams and on the floodplains. These consist mainly of swamp white oak, pin oak, elm, soft maple, sweet gum, black gum and ash.

About one-third (33 percent) of the Basin's area is used as cropland, with varying degrees of intensity. Corn, soybeans, truck crops, tobacco, hay, and meadow are the principal crops grown. The eastern areas, with some sections having as little as 9 percent cropland, grow small patches of vegetables and other specialty crops. Northwestern areas are as much as 70 percent cropland with corn and soybeans the major crops grown. Pastures occupy 16 percent of the Basin's land area. They consist of improved grasses, as well as native vegetation. Generally,

1/ Farmsteads, idle land (not idle cropland), wildlife areas, and other areas not classified as cropland, pasture, woodland or urban and built-up areas.

the eastern areas have higher portions of their land in pasture than do the more heavily cropped western areas. Total water area amounts to one percent including water areas of less than 40 acres.

The Basin contains various parts of 20 land resource areas, with a few lying completely within the Basin (Plate 4). Land resource areas are determined by similarity of climate, topography, geology, soil, vegetation, and agricultural development. Contrasts between land resource areas are usually rather sharp and in some instances very abrupt. There is virtually no correlation between the pattern of land resource areas and subbasins.

The principal land resource areas, in the Basin in extent are: (1) Indiana and Ohio Till Plain, which amounts to approximately 15 million acres and is generally well suited to crop and pasture use; (2) Cumberland Plateau and Mountains, extending over approximately 13 million acres, eighty percent of which is in woodland and represents much of the mining area; (3) Central Allegheny, covering about 12 million acres, three-fourths being in forests and a small portion being used for crops and pasture; and (4) Highland Rim and Pennyroyal of around 9 million acres, utilized primarily for general farming. Significant characteristics pertaining to size, topography, soils, land use and major crops in each land resource area are summarized as follows:

Significant Characteristics of Land Resource Areas, Agricultural Land, Ohio River Basin

Land Resource Area	Approximate Area	Average Annual Rainfall	Relief and Surface Drainage	Soil	Native Vegetation	Land Use and Major Crops
	1,000 acres	Inches				
98 Southern Michigan Drift Plain	491.2	33	Nearly level to gently sloping, glaciated plains. Many depressions occur throughout the level areas, often forming closed basins.	Glaciated, light colored, clayey and sandy soils. They are mostly acid and well to very poorly drained. Some peat and muck soils are present.	Native vegetation consisted of hardwood forests. Herbaceous vegetation is found in the bog areas.	Formerly forested, the area is now mostly cleared and used for growing feed grains, hay, wheat and a variety of other crops.
108 Illinois & Iowa, deep loess and drift	1,574.9	30--35	Rolling to hilly topography with broad, level to undulating uplands. Local relief ranges from a few feet to 100 or 200 feet. Majority of the areas has poor drainage, remainder is adequate.	Prairie soils from loess deposits dominate the area. Flats and depressions also have dark, poorly drained soils. Steep slopes have light colored soils with clay accumulation in subsoil.	Largely prairie grass such as Big and Little Bluestem, prairie count grasses, switch grass and sand lovegrass.	Nearly all in farms with about three-fourths in cropland. Corn, soybeans, other feed grains and wheat are main cash crops. Also, hay, pasture and livestock.
110 Northern Illinois & Indiana Till Plain	1,208.0	30--35	Nearly level to sloping glaciated plain. Streams have cut only shallow valleys over much of the area. Moderately good natural surface drainage. Poor drainage in spots.	Prairie soils on calcareous glacial material are dominant. Dark, poorly drained soil on flats and depressions. Small tracts of light colored soils with clay accumulation in subsoil in the north.	Tall prairie grass, mainly Bluestem. Some wet sites had Elm, Ash, Soft Maple, Tamarack, Cherry, Aspen, with understory of grasses, weeds, and sedges.	Mainly in farms, but Greater Chicago takes up about one-fifth of the area. Corn, soybeans, and other feed grains are main cash crops. Hay and dairying are also important.
111 Indiana & Ohio Till Plain	19,146.5	35--40	A gently sloping glaciated plain interrupted in places by ridges and knolls. Surface drainage good near streams, poor away from streams. Narrow, shallow valleys.	Light colored soils on glaciated material with clay accumulation in subsoil are dominant. Southern part also has wind-blown silts. Flats and depressions have dark, poorly drained soils.	Mixed hardwood forest, mainly oak, hickory, and tulip poplar.	More than 90 percent in farms and about four-fifths in cropland. Corn, other feed grains, soybeans, and hay are main crops. Some dairying and truck crops.
113 Central Claypan areas	1,564.8	26--42	Large portion of the area is gently sloping. Flat areas and depressions occur throughout the area.	Fertile, light and dark colored, well to poorly drained acid soils. The subsoils are mainly clayey.	The native vegetation consisted primarily of hardwood forests.	Dairy farming is important. Canning crops, corn, wheat, beans and sugar beets are among the leading crops. Fruit growing is important in localized areas.
114 Southern Illinois & Indiana Thin Loess & Till Plain	5,816.1	35--45	Glaciated plain divided by ridges with steep slopes. Most of the ridge tops are narrow, some are broad. Surface drainage is generally good, but is poor on flat ridge tops.	Light colored soils developed in thin loess and leached glacial till. Clay accumulation in subsoil. Some fragipans. Alluvial soils in flood plains. Strong acidity in southern part.	Mixed hardwood forest, mainly oak, hickory and tulip poplar.	Nearly all in farms but only about one-half in cropland. Corn, soybeans, other feed grains and hay for dairy and other livestock are main crops. About one-fifth in forest, remainder in pasture.
115 Central Mississippi Valley Wooded Slopes	4,158.8	35--45	Glaciated plain crossed by steep ridges. Small streams have narrow valleys and steep gradients. Major rivers have broad, fairly level flood plains. Most drainage is good, slow runoff from areas along streams.	Light colored soils over glaciated material and bedrock. Ridge tops in southern part have fragipans. Flood plain soils consist of alluvium and dark, poorly drained soils. Generally strong acidity.	Mixed hardwood forest, mainly oak, hickory and tulip poplar.	Nearly all in farms with about two-fifths in cropland. Corn, other feed grains, hay, pasture and livestock. Peach and apple orchards are important. About one-third in forest.

Significant Characteristics of Land Resource Areas, Agricultural Land, Ohio River Basin (cont'd.)

Land Resource Area	Approximate Area	Average Annual Rainfall	Relief and Surface Drainage	Soil	Native Vegetation	Land Use and Major Crops
	1,000 acres	Inches				
120 Kentucky & Indiana Sandstone & Shale Hills & Valleys	7,150.1	40--48	Gently rolling to hilly sandstone and shale plateau with a loess cap. Surface drainage is good except in flat areas of plateaus and alluvial bottoms.	Light colored soils with a thin to moderately thick loess mantle over residuum from acid sandstones and shales are dominant on the smooth flats and low hills. Some alluvial flood plains. Generally strong acidity.	Mixed hardwood forest, mainly oak, hickory and tulip poplar.	Nearly all in farms with about 40 percent in cropland and 50 percent in forest. About 5 percent urban. Considerable strip mining. Corn, soybeans, other feed grains and hay in support of dairying and other livestock. Some tobacco and apple and peach orchards.
121 Kentucky Bluegrass	6,171.6	About 46	Undulating to rolling central limestone plain surrounded by shale and limestone hills with narrow ridge tops and steep sides. Relief varies from a few feet to 500 feet. Good to excessive surface drainage.	Light colored soils on rolling to hilly uplands underlain by clacareous rocks are dominant. Also reddish-yellow soils deeply weathered phosphatic limestone. Most soils are acid except the steep limestone hills.	Mixed hardwood forest, mainly oak, hickory, and tulip poplar.	Most of the land is in farms but slightly less than one-third is cropland. Corn, other feed grains and hay in support of livestock are the principal crops. Tobacco is important cash crop.
122 Highland Rim & Pennyroyal	9,451.1	45--54	Plateau divided by ridges, especially in the west. Steep slopes and narrow valleys. Most of the surface drainage is good except it is poor in flat areas.	Light colored soils with clayey subsoil are dominant throughout the area. These soils are developed mainly in this loess and residuum from limestone. Some alluvial flood plain soils. Medium to strong acidity.	Mixed hardwood forest of oak, beech, red cedar, tulip poplar.	Mainly in farms with about 40 percent in cropland. Corn, other feed grains, and hay in support of livestock. About one-sixth of the area in pasture, one-third in forest.
123 Nashville Basin	1,909.8	About 50	Gently rolling to hilly limestone plain in central part with relief from a few tens of feet to about 100 feet. Other margins have steep ridges with relief of several hundred feet. Mostly good surface drainage.	Reddish yellow soils from limestone are extensive. Also large areas of limestone rock land. Alluvial soils in flood plain. Acidity present except in limestone areas.	Mixed hardwood forest of oak, beech, red cedar, tulip poplar and hickory.	Nearly all in farms with about 40 percent in cropland. Grain and hay in support of beef and dairy cattle are main crops. About one-third of area in pasture, one-fourth in forest.
124 Western Allegheny Plateau	5,035.4	40--45	Plateau divided by rolling to steep ridges. Level valley floors. Local relief is from 100 to several hundred feet. Rapid surface drainage.	Light colored soils with accumulation of clay subsoils are dominant. Soils are moderately deep to shallow overlapping shale and sandstone. Natural fertility generally low. Most soils strongly acid.	Mixed hardwood forest, mainly oak, hickory and tulip poplar.	Mostly in farms but about one-fourth in other uses. Main crops are hay and feed grains. Fruit and vegetable growing are important. About one-fifth of area in pasture, two-fifths in forest.
125 Cumberland Plateau & Mountains	12,743.7	42--56	Sandstone and shale plateau divided by steep-sloped ridges separated by narrow level valleys. Local relief is mostly from a few hundred feet to over 1,000 feet. Surface drainage is good to excessive.	Brown acid soils are the principal groups on hilly and steep slopes. Small areas of rough stony land and rock outcrop. Alluvial soils on flood plains and valley floors. Generally low fertility and strong acidity.	Mixed hardwood forest with oak predominantly.	About 80 percent in forest, mainly private ownership. Coal mining is the major industry. About five percent of the area in cropland, slightly less in pasture. Main crops are tobacco, corn and truck crops.

Significant Characteristics of Land Resource Areas, Agricultural Land, Ohio River Basin (cont'd.)

Land Resource Area	Approximate Area	Average Annual Rainfall	Relief and Surface Drainage	Soil	Native Vegetation	Land Use and Major Crops
	1,000 acres	Inches				
126 Central Allegheny Plateau	11,778.6	35--45	Plateau that is sharply divided by numerous ridges with steep slopes and narrow level valleys. Local relief is from a few hundred to several hundred feet. Surface drainage is largely good to excessive.	Light colored soils derived from interbedded sandstones and shales are dominant. Clay subsoil. Terrace soil along the Ohio River. Also alluvial soils in the Ohio River flood plain. Strong acidity except in cases of local limestone.	Mixed hardwood forest, mainly of maple, beech and some oak.	About three-fourths in forests mainly small private ownerships. Lumber, wood use industries, and coal mining are main industries. About one-tenth in cropland, mainly hay and other feed crops for dairy cattle.
127 Eastern Allegheny Plateau & Mountains	6,341.9	40--60	Deeply divided plateau terminating in a high escarpment on the east. Steep slopes are dominant but level to gently rolling plateau remnants appear in the north. Drainage is mostly good to excessive.	Brown acid soils from gray sandstone and red shales are dominant on the extensive steep slopes. Alluvial and dark, poorly drained soils in the flood plains of larger streams. Strong acidity in general.	Mixed hardwood forest, mainly of maple, beech and some oak.	About three-fourths in forests, mainly small private ownerships. Lumbering, wood use industries and coal mining are main industries. About one-tenth in cropland, mainly hay and other feed crops for dairy cattle.
128 Southern Appalachian Ridges and Valleys	2,271.2	35--55 Increasing from north to south.	Northeast, southwest trending valleys separated by steep ridges or mountains. Valleys are undulating to strongly rolling or hilly. Most surface drainage is rapid.	Light colored soils with clay subsoil. Considerable areas of limestone. Steep ridges are sandstone, shale and rock soils. Narrow flood plains are alluvial. Medium to strong acidity except in limestone area.	Mixed hardwood forest, mainly oak, hickory and tulip poplar.	About one-half of the area is forest, one-sixth in cropland, and one-sixth in pasture. Feed and forage for livestock. Tobacco is main cash crop.
130 Blue Ridge	1,230.4	42--54	Mountains and valleys and dissected plateaus.	Soils developed in material weathered from sandstone, shale or limestone. They are light or moderately dark colored and have principally uniform loamy or light clayey profiles.	Mixed hardwood forests grew on the land originally and still occupy much of the area.	Small general farms are characteristic of much of the area, but there are some large dairy and livestock farms. Corn, small grains, and hay are the most extensive crops. Tobacco is an important cash crop. Forests are on about half of the area.
139 Eastern Ohio Till Plain	1,462.3	35--40	Gently to strongly rolling glaciated plateau. Stream valleys are narrow and shallow. Majority of surface drainage slow. Small percentage rapid, remainder moderately good.	Glacial drift with slow permeability in general due to fragipans or clay subsoil. Some areas of gravelly and sandy ridges and potholes. Medium fertility, medium to strong acidity.	Mixed hardwood forest, mainly oak, sugar maple and beech.	Mostly farms. Highly intensive dairy area. Principal crops are corn, small grains and hay. Considerable acreage of truck crops. About one-fifth of area in forest.
140 Glaciated Allegheny Plateau and Catskills	2,065.7	30--40	Plateau divided by steep ridges with broad, nearly level to moderately sloping tops. Narrow valleys with smooth floors. Majority of surface drainage rather poor, some moderately good.	Moderately deep to deep, somewhat stony, medium-textured, acid soils with fragipans are dominant. Shallower and more stony soils on steeper slopes. Deep, loamy, well-drained soils in valleys.	Mixed hardwood forest, mainly beech, birch and maple.	Mostly in farms but large areas are forested. Much of Catskills used mainly for recreation. Hay, pasture, some grain and dairying. Considerable quantities of commercial poultry, potatoes, fruit, and vegetables.

IV - THE AGRICULTURAL AND FOREST ECONOMY

Agriculture and forestry are important parts of the Basin's economy. Agriculture's output including forestry and fisheries is valued at $4.5 billion annually or seven percent of the total industrial output 1/. About 6.5 percent of the civilian labor force is employed in agricultural production. Indirectly, agriculture makes a much greater contribution to the economy. Large quantities of machinery, fertilizer, petroleum and other industrial products are used in the production, marketing and processing of food and fiber. Employment in these industries likewise is related to agriculture.

Current Farm and Rural Nonfarm Economy 2/

The agriculture of the Basin also is quite significant in the national farm production. One-fourth of the Nation's tobacco, 18 percent of the soybeans, 15 percent of the corn, and 16 percent of the hogs are produced; as well as important shares of wheat, hay, dairy and poultry products 3/.

The current farm and rural nonfarm economy is characterized by rapidly changing conditions. The acreage of land devoted to agriculture is shrinking as nonfarm developments expand. Changes are also occurring within agriculture. Much of the statistical material used in the study was based on the 1959 Census of Agriculture. More up-to-date data was utilized wherever possible.

General Farm Characteristics: In the Basin, most of the land is included in farms, however the proportion varies widely among the subareas 4/. Several of the eastern and southern subareas, have less than half of the land area in farms. In the Wabash, White, Scioto and Little Miami-Great Miami more than three-fourths is farmland. The latter four subareas have about 37 percent of all the farmland in the Basin.

The number of farms in the Basin continues to decline as a result of mechanization and the attraction of farmers to other jobs. Frequently,

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1/ Projective Economic Study of the Ohio River Basin (pp. 10-17), Appendix B, Ohio River Basin Comprehensive Survey, U. S. Army Engineer Division, Cincinnati, Ohio, August 1964.

2/ More detailed information on the agricultural economy of the Basin is contained in two previous ERS Reports: The Agricultural Economy of the Ohio River Basin, March 1964, and Agricultural Activity in the Ohio River Basin, 1980-2010: A Projective Study, May 1966.

3/ Agricultural Economy of the Ohio River Basin (pp. 7-9), RDED, ERS, USDA, March 1964.

4/ The acreage in farms includes forest land.

ownership changes and holdings are abandoned or added to existing farms. Thus, there were about half a million farms in the Basin in 1959, however the number is undoubtedly smaller at the present time. Likewise, the average size of farms continues to grow. The present acreage is 15 to 20 acres above the 125-acre average of 1959. Farm sizes vary widely within and among the subareas. Many small farms are in areas near large cities and some of these are operated on a part-time basis. Farm size is also limited by topography. It is larger in areas where urban population is less, where cash crop farming predominates and where there are fewer obstacles that limit farm consolidation.

The majority of farms in the Basin are family-type units operated wholly or partially by their owners, with relatively little hired labor. In general, the proportion of full owners, (those who own all the land they farm) is lower in the more productive farming areas such as the Wabash, White and Scioto. Conversely the ratio of tenants is higher in these subareas. For the entire Basin, about two-thirds of the operators are full-owners and less than 15 percent rent all of the land they operate.

The value of land and buildings, on a per-acre and per-farm basis is in a period of rapid change. This is caused by upward trends in land values and farm sizes. Values per acre are highest in the most productive soil areas and in areas of expanding community development. The Little Miami-Great Miami, Wabash, White, Scioto, and Pittsburgh Standard Metropolitan Statistical Area (SMSA) are the leading subareas in value per acre. Because of its small average size farm, however, the Pittsburgh SMSA Subarea ranks much lower in average value per farm.

More than one-half of the farms in the Basin are classified as commercial farms by the Bureau of the Census, i.e., they sell $2,500 or more of farm products annually. These units are concentrated in the more rural and the highly productive soil areas. Part-time and retirement farms are more evident near the cities and in less fertile soil areas. About one-half of the farm operators in the Basin do some off-farm work, with one-third working off the farm 100 days or more a year.

Crop Production and Yields: Of the 33.8 million tons of crops produced in the Basin over half are feed crops (corn, oats and barley, Table 1). Most of this production comes from the Wabash, White, Little Miami-Great Miami and Scioto Subareas. Food crops (wheat, soybeans, dry field beans, and potatoes), especially soybeans and wheat, also are major crops in these areas. Roughage (hay, silage, and cropland pasture) production is much more important than food or feed crops in the eastern and southern subareas. Yields per acre of crops rise as advances in production technology are adopted. Illinois and Indiana, two of the major corn-producing states in the Basin, reported state average corn yields in excess of 90 bushels per acre in 1964 and 1965. Yields in some counties in the Wabash Subarea averaged above 100 bushels. A major factor in yield increases is the application of fertilizer, which is being applied in larger quantities over increasing proportions of cropland and pasture.

Livestock Production: Production of livestock and livestock products is distributed more widely among the subareas than the production of crops. The Wabash and White are the only subareas contributing more than 10 percent of the Basin's total (Table 1). In the western portion of the Basin, hogs, cattle and eggs are the most important products, while dairy and poultry dominate the production picture in the eastern areas.

Income: Annual income from the sale of crops, livestock and livestock products amount to $2.4 billion, about 60 percent of which comes from livestock (Table 2). Livestock income exceeds crop income in all subareas except the Guyandotte-Big Sandy-Little Sandy, Licking-Kentucky-Salt, and Wabash. In general, the ratio of livestock income to crop income is greater in the eastern parts of the Basin.

Employment and Population: As previously mentioned, the number of farms is declining because of mechanization and consolidation of smaller units into larger operations. Farm employment has followed this downward trend in the Basin as well as the Nation. Decreases have been relatively larger in the less productive farming areas. Less than half a million people were employed on farms in 1960 (Table 3). Indications are that further reduction has taken place since. Farm population, closely related to employment, also has dropped. It was 1.8 million, or 8 percent of the total population in 1960. This ratio is smaller today because of increases in total population and further decreases on farms. Farm population in the Ohio is 8.7 percent of the national farm population.

Programs in land and water resource development administered by U.S.D.A. Agencies contribute significantly to local employment. Local labor, goods, and services are utilized extensively in resource conservation developments.

An example of this can be cited in connection with the Department's responsibilities in upstream watershed protection and flood prevention projects. From 20 to 30 percent of the construction cost usually goes for local labor, fuels, equipment, etc. The operation and maintenance of these projects is a local responsibility and is accomplished through the use of local resources. It is through this program that many communities have been assisted to achieve development goals to increase income of people living in rural areas and to eliminate the causes of underemployment. Job opportunities and development of income-producing recreation become important aids to the local employment situation as a result of these programs.

The Agricultural Conservation Program provides assistance through cost-sharing arrangements to farmers on conservation practices. Aid is also made available to them on soil and water conservation measures in conjunction with the Conservation-Credit Program of the Farmers Home Administration.

In addition, there are other U.S.D.A. programs having a favorable impact on local employment. But they are generally not as directly oriented to resource developments as the examples previously mentioned.

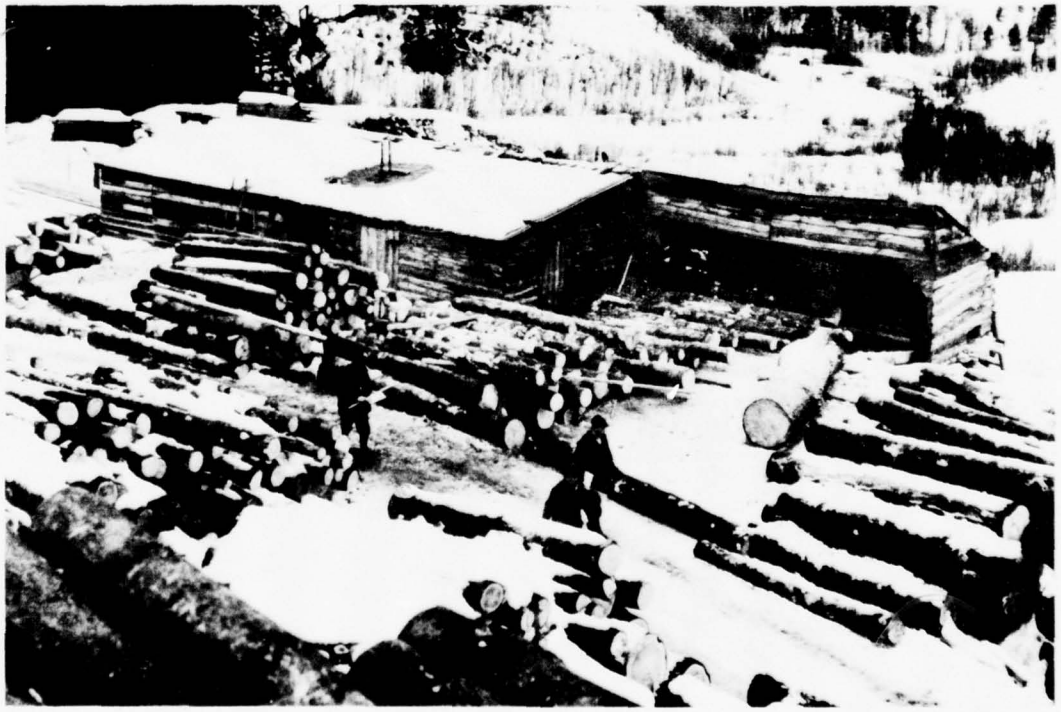
Cattle production is important in the western portion of the Basin.

Dairying is dominant in the eastern areas.

Rural Nonfarm Economy: More than 8 million people are classified as rural residents by the Bureau of the Census. Since the farm population is only 1.8 million, the rural nonfarm population is $3\frac{1}{2}$ times as large as the farm population. Statistics on their contribution to the economy were not available. However, many rural nonfarm people are employed in industries closely related to agriculture. Some are directly engaged in farm production even though they do not reside on farms. They do have an impact on the use and management of land and water resources in rural areas, particularly in areas close to the larger cities. Their influence is frequently associated with relatively high values of land and water resources.

Current Forest Economy

Timber products play an important part in the development and economy of the Ohio River Basin. While sawlog production remains of primary importance, the production of pulpwood began in more recent years and this output is expected to show the greatest gain during the period of this study.



Lumber Manufacturing - One of the major forest products industries in the Basin.

Volume: Table 4 shows the volume of merchantable timber on the commercial forest lands. Of the 33 billion cubic feet of total growing stock volume 1/, three-fifths is in sawtimber trees 2/. The bulk of industrial wood (lumber, veneer, cooperage and other products) is cut from this larger timber. The remaining two-fifths of the growing stock volume is in trees of poletimber size. Hardwood 3/ species comprise most of the timber volume, accounting for 94 percent. The balance is in softwoods 4/.

Quality: The total volume of timber includes a variety of species and qualities with a wide range of suitability for timber products. Hence, figures on timber resources in terms of volume alone have serious limitations when used to appraise the usable supply of timber. Quality of timber resources is of major importance in determining the competitive strength of the timber industries.

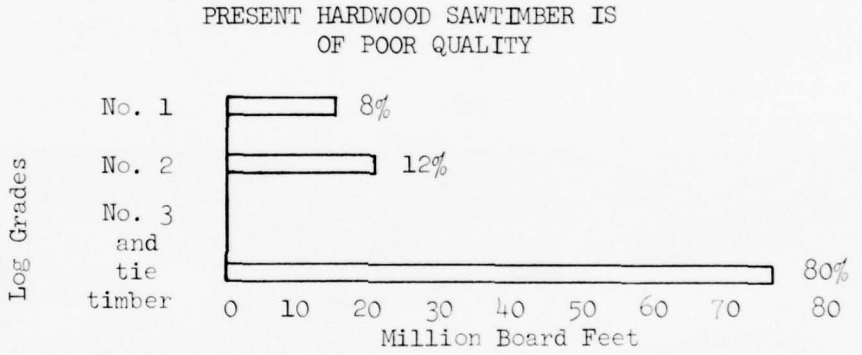


Figure 1

Four-fifths of the standing sawtimber volume is of No. 3 and tie-timber grade (Figure 1). This hardwood log grade pattern reflects both high grading practices that have removed better quality trees and also significant increases in small trees resulting from management and better fire protection. Tree size is an important consideration in log grading as shown in Figure 2. Present log grade and diameter class distribution does not support strong forest industries which need sawtimber trees as their raw material.

1/ Volume of sound wood in the bole of sawtimber and poletimber trees from stump to a minimum 4.0 inch top outside bark or to the point where the central stem breaks into limbs.

2/ Live trees of commercial species containing at least a 12-foot sawlog.

3/ Dicotyledonous trees, usually broad-leaved and deciduous.

4/ Coniferous trees, usually evergreen, having needle or scale-like leaves, includes pine, cedar, cypress, spruce and hemlock.

44 PERCENT OF SAWTIMBER VOLUME IS IN
TREES OF THE SMALL DIAMETER CLASS

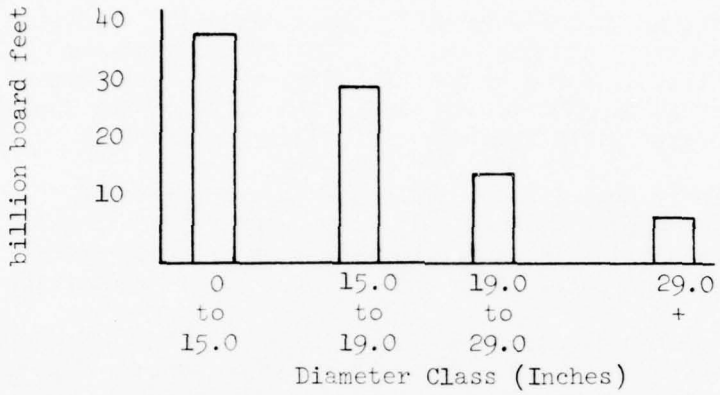


Figure 2

Growth, Cut, Inventory: Table 5 shows the net annual growth 1/ of growing stock. Growth rates averaged 33 cubic feet per acre in 1962. The average net annual growth of sawtimber per acre was 108 board feet.

In 1962 the volume of timber cut from growing stock was 389 million cubic feet, a decrease of 72 million cubic feet or approximately 16 percent from the 1952 cut volume (Table 6). The sawtimber cut decreased from 1,945 million board feet to 1,666 million board feet in these respective years.

Table 7 shows timber products output for 1952 and 1962 for sawlogs, veneer logs and minor industrial products; for pulpwood; and for fuelwood.

Because of the present available wood resource, cutting could be increased in most areas for most species. However, the growth-cut relation is not the same for all species and sizes of timber since most of the growth is in smaller trees, whereas most of the cut is from larger timber.

The volume of small material that can be used for pulpwood and other similar products is increasing where size and quality are not important considerations. On the other hand, the volume of large and high quality timber of preferred species is overcut and becoming more difficult to find.

Table 8 shows timber inventories of growing stock for 1952 and 1962. Primarily because of reduced cutting during this decade, timber inventories

1/ The annual change in volume of sound wood in live sawtimber and poletimber trees during a specified period resulting from natural causes.

in growing stock increased from approximately 25.5 billion cubic feet to almost 34 billion cubic feet or nearly 34 percent. During this same period, sawtimber inventories increased from approximately 75,500 million board feet to over 97,000 million board feet.

Value: Statistical tables were not prepared covering the value of forest products. However, stumpage values 1/ of forest products in 1962 approximated $40 million. Based on the 1958 figures in the Economic Importance of Timber in the United States 2/, the value of the finished products to the consumer would approach one billion dollars.

Employment: The income from payrolls for the forest based industrial activities approximated a half-billion dollars during 1962. This included $142.5 million in the lumber and wood products industries 3/, and $342.5 million in the pulp, paper and allied products industries 4/.

Forest-based employment amounted to 98,152 in 1962 in Major Groups 24 and 26 5/. This was an increase of 6,368 or approximately 7 percent more than in 1952. Table 9 shows this employment by subareas.

The National Forests contribute to the economy in many ways. Twenty-five percent of the total receipts from timber sales, mineral royalties, and land uses are returned to the counties having National Forest land. These funds are used for roads and schools.

National Forests are actively managed for outdoor recreation, timber, water, and wildlife. Many recreation areas and interpretive centers are being developed to satisfy public desires for outdoor recreation. Timber stands, watersheds, and game and fish habitat are being improved to enable greater yields in the future. Roads and trails are constructed and maintained to serve National Forest areas. Fire Control and Insect and Disease Control protect National Forest areas. These activities,

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1/ The value of timber as it stands uncut in the woods.

2/ The Economic Importance of Timber in the United States. Forest Service, U. S. Department of Agriculture. Miscellaneous Publication 941.

3/ Includes logging camps engaged in cutting timber, sawmills, veneer mills, lath mills, shingle mills, cooperage-stock mills, planing mills, and plywood mills engaged in producing lumber, veneer, and plywood, and wood basic materials; and establishments engaged in manufacturing finished articles made entirely or mainly of wood (Major Group 24 as defined by the Bureau of the Census).

4/ Includes establishments manufacturing pulp primarily from wood and converting this pulp into paper or board; and the manufacture of paper and paperboard into converted products such as coated paper, paper bags, paperboard boxes, and envelopes (Major Group 26 as defined by the Bureau of the Census).

5/ As defined by the Bureau of the Census.

financed by federal funds, provide considerable local income through salaries, supplies, contracts, and services to National Forest users. Recreation visits to the Forests in 1964 totalled over 3,450,000.

Land and Water Areas--Present Major Land Use

Only about 1 percent of the total geographic area is in water (Table 10). Land area of the 19 subareas varies in size from 1.8 million acres in the Beaver to 12.3 million in the Wabash. The large size of the Wabash coupled with its highly productive soils makes it outstanding in any comparison of production and other items among the subareas. It contains about 12 percent (one-eighth) of the 103 million acres of land in the Basin. The Cumberland, Kanawha-Little Kanawha and White are also important in terms of total land acreage.

Less than 5 percent of the land area is in urban and built-up uses. This includes highways, golf courses, airports and towns of 2,500 and more, as well as land in places classified as "urban" or "urbanized" by the Bureau of the Census. The Guyandotte-Big Sandy-Little Sandy Subarea has the smallest proportion in this use, while the Pittsburgh Standard Metropolitan Statistical Area has the highest.

Most land in the Basin is devoted to agriculture and forestry. At first glance, the agricultural land resources appear to be definitely under utilized. Half of the total cropland and pasture acreage is either idle or in permanent pasture (Table 11). However, in its present state, this half of the acreage is generally less productive and not well adapted to crop production. On the other half, feed crops are the most important of the major crop groups, accounting for nearly one-fourth of all cropland and pasture. Food crops make up about one-eighth of the total.

Agricultural and Forest Lands dominate land use.

Food crop acreage is concentrated in the Wabash and White Subareas. They contain almost two-thirds of the total acreage of these crops, while making up only one-third of the acres available for crop and pasture production. Much of the food crop acreage is in soybeans, a crop that is gradually displacing small grains and forages on many farms. Feed crops also are important in the Wabash and White. The Wabash Subarea alone accounts for 32 percent of the Basin's feed crop production. Crop roughages and permanent pasture are distributed more uniformly among the various subareas.

Nearly 40 percent 1/, of the Basin is forest land 2/. Ninety-nine percent is classified as commercial forest land, or as land which is either producing or capable of producing crops of industrial wood and is not withdrawn from timber utilization. Only 1 percent is classified as noncommercial forest land - either unsuitable for timber growing because of low productivity or because of legal reservations for recreation and other non-timber uses.

The commercial forest land not only provides industrial wood, but also is important in contributing to water, recreation, fish and wildlife resources. The extent to which this land can supply the timber demands of the Basin will be influenced by land area, ownership pattern, degree of stocking, composition of stand sizes, and future forest management and protection programs.

Approximately half the commercial forest land is found in the Kanawha-Little Kanawha, Cumberland, Allegheny, Licking-Kentucky-Salt, Guyandotte-Big Sandy-Little Sandy, and Monongahela Subareas (Table 12). In contrast, the Wabash and Little Miami-Great Miami are only 10 percent forested.

Availability of timber depends greatly on the decisions of individuals, corporations, and public owners of forests (Figure 3). Table 12 shows this ownership in the 19 Economic Subareas.

Private owners include a great variety of business and professional people, housewives, wage earners, mining and landholding companies, and others. Most are engaged in occupations or enterprises not directly connected with timber production.

About three-fifths of the commercial forest land is 70 percent or more stocked with growing-stock trees (Table 13). Most of this stock is of poor quality.

1/ "Basic Forest Resource Statistics for the Ohio River Basin" - U. S. Forest Service, as appended March 29, 1966.

2/ Land at least 10 percent stocked by forest trees of any size, or formerly having such tree cover and not currently developed for nonforest use. Does not include urban or thickly settled residential and resort areas, city parks, orchards, farmsteads, improved roads, or lands developed and maintained for nonforest use by fencing, seeding, etc.

Forests - a major land use.

COMMERCIAL FOREST LAND IS MOSTLY
IN PRIVATE OWNERSHIP

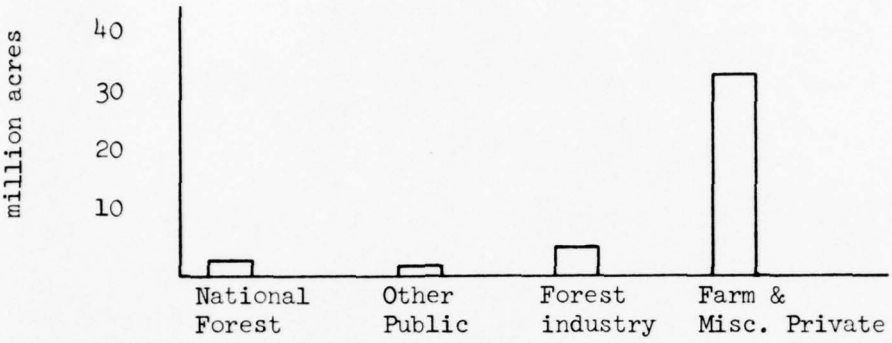

Figure 3

Sawtimber stands 1/ on about 18 million acres, occupy 43 percent of the commercial forest area (Figure 4). Many of these sawtimber stands are composed of sound young growth which has developed over the past two decades through better management and protection. Primarily, the increase is due to improved fire protection.

NEARLY HALF OF THE COMMERCIAL FOREST
AREA IS IN SAWTIMBER STANDS

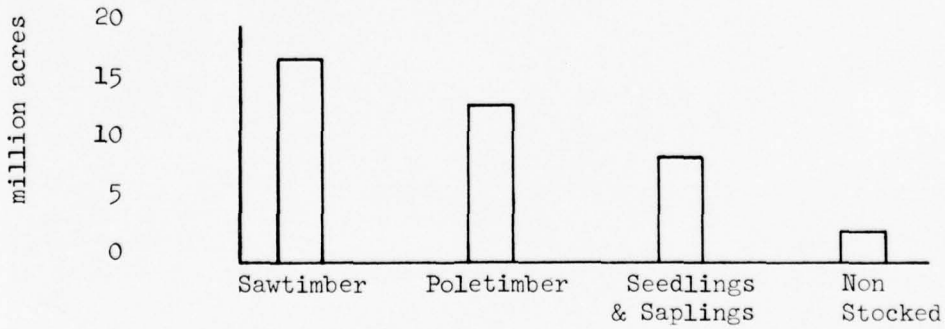

Figure 4

1/ Stands at least 10 percent stocked with growing stock trees, with half or more of this stocking in sawtimber or poletimber trees and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands 1/ on about 14 million acres occupy 35 percent of the commercial forest area, and seedling and sapling stands 2/ occupy about 20 percent. Nonstocked stands 3/, comprising 2 percent of the commercial forest land, are often occupied by grass or other vegetation that inhibits restocking of trees. Table 14 shows the area of stand-size classes by subareas.

National Forest land accounts for 5 percent of the commercial forest land in the Ohio River Basin. There are National Forests and Purchase Units in 8 of the 11 states and in 13 of the 19 subbasins (Plate 2).

Another 3 percent is held by other public bodies or government agencies. State forests account for most of this - approximately 525,000 acres, and are usually well managed for the several renewable resources and land uses. Besides their forests several States have game and fish lands. Some of these are managed for timber production under approved management practices. Forest industries 4/ own about 3 percent of the commercial forest land. These lands are held primarily for timber supplies.

Military agencies of the United States own or administer commercial forest lands within bases, arsenals, depots, and other lands.

Most of the noncommercial forest lands are in National, State, County, and municipal parks. State, County, and municipal parks are usually intensively managed for recreation. Federally owned lands administered by the National Park Service approximate 63,000 acres in ten sites and in six of the subareas. Usually, no commercial cutting of timber is permitted in areas intensively managed for recreation.

A total of approximately 380,000 acres of Federal land are administered by the U. S. Army Corps of Engineers around their reservoir and navigation projects. Much of this is in noncommercial forest land.

While not significant from the timber standpoint noncommercial forest lands do have substantial values in contributing to the water and wildlife resources in addition to recreation and natural beauty.

Surface mining for several of the mineral resources has been conducted for many years in the Ohio River Basin. Clay was and is still used for building. Brick structures constructed 80 to 100 or more years

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1/ Stands at least 10 percent stocked with growing stock trees, and with half or more of this stocking in sawtimber and/or poletimber trees and with poletimber stocking exceeding that of sawtimber.

2/ Stands at least 10 percent stocked with growing stock trees and with saplings and/or seedlings comprising more than half of this stocking.

3/ Stands less than 10 percent stocked with growing stock trees.

4/ Lands owned by companies or individuals operating wood using plants.

ago are still in evidence. Many tons of limestone from the numerous quarries are used for various purposes such as agriculture, road building, and driveway surfacing, and concrete. In some areas the quality is satisfactory for manufacture of cement. Production of "Indiana limestone" for building is produced by the many quarries in the central part of that State. It is still prized and shipped extensively - especially for construction of public buildings. Building limestone and sandstone are also quarried in other areas.

Generally these operations have disturbed few surface acres and have not created extensive rehabilitation problems. In contrast, strip mining for coal has left vast, unsightly areas of nonproductive land. Bituminous coal is mined by this method both in the Appalachian Region, Eastern Province, and in the Eastern Region, Interior Province (the more flat to rolling western part of the Basin). In the steep Appalachian Region, Eastern Province, coal veins are also exposed by rimcutting.

As technology has developed coal mining machinery has become larger. This in turn requires wider working widths to operate equipment and consequently disturbs larger acreages. Truck-haul roads from railroads or using plants to these operations also require more land with corresponding problems associated with this disturbance.

There are strip mine operations in nine States or Commonwealths in the two Provinces mentioned. These operations occur or have occurred in 145 counties. Table 15 shows present status of strip mine operations by subareas.

Projected Farm Economy 1/

The projected farm economy of the Basin is based on a number of assumptions concerning other sectors of the economy at national and international levels, as well as the farm economy outside the Basin.

The general economy of the United States is assumed to be prosperous during the projection periods. This is consistent with assumptions concerning general economic conditions in Appendix B, Projective Economic Study of the Ohio River Basin, page 3: "A high level of national employment and activity, no major depressions or (global) wars, and a continuation of the current relative needs of the civilian economy and national defense." Disposable income per capita is expected to increase, but relatively small proportions of the increase will be expended for food. Increases in total food consumption per capita are not expected, but changes in the combination of food items purchased are likely.

Population growth rather than changes in per capita consumption, will be the major factor responsible for increases in demands for food and fiber. The assumptions on population are identical with those in

1/ A more detailed description of the projected farm economy is provided in a previous ERS Report "Agricultural Activity in the Ohio River Basin 1980-2010: A Projective Economic Study," May 1966.

Appendix B.

Demands for food and fiber production are also affected by exports and imports of agricultural products. Exports of food and feed crops are expected to increase 100 percent and 80 percent respectively by 1980 and to remain at the 1980 level in 2000 and 2020 1/. Exports of livestock and livestock products are assumed to be balanced by imports in all projection years.

Livestock feeding efficiencies affect the amounts of feed crops and pasture needed to satisfy the demand. Increases in efficiency, i.e., decreases in feed requirements per unit of product, are projected for all classes of livestock and livestock products 2/.

The factors mentioned above affect the demand for agricultural production at the national level. The share of national demands allocated to the Ohio Basin was based on past and current trends and the judgment of commodity specialists in the U. S. Department of Agriculture.

It is assumed that, in general, the demands for food and fiber from the Basin will be met. The additional production is expected to come from changes in land use as well as increases in crop yields and livestock production. These yield and production increases will come from the development and use of new varieties and strains of livestock, crop and pasture plants; improved fertilizers and pesticides and more timely operations. These projections imply that there will be a high proportion of commercial farms operated by farmers who will be willing and able to respond to changes in demands for food and fiber. Per-acre yield increases of 54 percent for corn, 51 percent for wheat and 80 percent for alfalfa hay are projected for the 1959-1980 period. After 1980, yields will rise less rapidly, with increases expected to occur throughout the projection period.

Food crop production is expected to rise more than 80 percent by 1980 (Table 16), though acreage would increase by only 26 percent. Feed crop production would be 46 percent higher while acreage actually declines. The larger increase in food crops is mainly due to the rapid increase in soybean production, in response to a projected doubling of demand between 1959-61 and 1980.

Food crop production is projected to decline in eight subareas, most of which are in the eastern and southern part of the Basin. The largest increases are expected in the Lower Ohio-Evansville and Green, where production will more than triple. Gains and losses in feed crops are mixed among the subareas. The large increase in the Kanawha is due to a sharp upward trend in acreage of oats. Increases in the Scioto and Little Miami-Great Miami result from larger acreages of both corn and oats,

1/ ERS Report, "Agricultural Activity in the Ohio River Basin, 1980-2010: A Projective Study," (p. 45) May 1966.

2/ Ibid., p. 40.

along with higher average yields.

Changes in roughage crops between now and 1980 are expected to be smaller than those in food and feed crops. Larger acreages are projected, however, for all subareas except the Monongahela and Beaver, with the greatest percentage growth in the Scioto, Little Miami-Great Miami and Ohio-Louisville.

Production of all major crop groups is projected to continue its upward trend in almost all subareas between 1980 and 2020 (Tables 16 and 17). Total crop production will be 16 percent higher in 2000 than in 1980 with most of the increase coming in food and feed crops. Between 2000 and 2020 further expansion of output is expected. Total crop production in 2020 will be 19 percent above the 2000 level and again, the bulk of the increase will be in food and feed crops (Table 16).

Livestock production, like crop production, is projected to expand in each of the projection years (Table 17) and to account for a larger part of total production in 2020 than in 1980 1/. Some decreases in production are expected between the present and 1980 in five subareas, although within the Basin total livestock production will be about one-fifth higher in 1980. Beyond 1980, production will increase in each subarea, but the amount of change will vary from one area to another. The Wabash and White will continue to lead in production, even though the Allegheny, Ohio-Huntington, and Kanawha-Little Kanawha will make larger gains in proportion to their 1980 output.

Farm Employment: Farm employment is projected to decline by 45 percent from present levels to 1980 for the Basin as a whole. Decreases are expected to range from 16 percent in the Wabash to more than two-thirds in the Ohio-Huntington, Licking-Kentucky-Salt, and Cumberland (Table 18). While the decline will likely be less rapid after 1980, total employment in 2020 will be less than one-third the present level.

Population: Rural farm population, being closely related to farm employment, also is projected to decrease rapidly. A drop of 35 percent from present levels is expected by 1980. As would be expected, the smallest decreases are projected for the more productive agricultural areas such as the Muskingum, Scioto, Wabash, and White. Much larger percentage declines are expected in the Guyandotte-Big Sandy-Little Sandy, Licking-Kentucky-Salt, and Cumberland Subareas, which are less productive and in the Pittsburgh and Cincinnati areas, where agriculture will gradually be displaced by urban expansion.

Beyond 1980, farm population will decline gradually in the Basin as a whole. The number of people on farms in 2020 will be less than one-third of the current level. In some subareas it will be less than one-fourth.

1/ "Livestock" actually refers to livestock plus products such as dairy products and eggs.

Projected Forest Economy

Timber projection data were first assembled for the Economic Area of the Ohio River Basin and then prorated to individual subareas using historical information as a guide. Projections of timber growth, cut, and inventory were developed through a procedure similar to that used in "Timber Trends" 1/.

Three major assumptions were made:

1. Over time there is not expected to be an appreciable change in the commercial forest area of the Basin.

2. Timber cut in the Ohio River Basin will increase at the same rate as that shown for the Northern Region of the United States in "Timber Trends".

3. Timber cut will be approximately equal to timber growth by the year 2020.

Overall timber production decreased during the decade 1952-1962. This trend is expected to reverse and both sawlog and pulpwood production will rise before 1980 and continue to rise until 2020. Fuelwood production will continue a steady decline through the projection years.

The net annual growth of all species will decline from 1962 to 1980 after which net growth volumes will increase. This is true of both growing stock and sawtimber stands (Figure 5).

This increase in net annual growth after 1980 reflects many poletimber size stands reaching sawtimber class and some seedling and sapling size stands reaching poletimber class. Most of this growth will be in hardwood species with over nine-tenths of the sawtimber growth being in the hardwoods. Intensified protection and management in all timber stands are also assumed after 2000. Table 5 shows the net annual growth of growing stock in the subareas.

Timber cut increases in both growing stock and sawtimber stands after 1962. In growing stock stands this figure is expected to increase almost four times between 1962 and 2020. At the same time the sawtimber cut increases from 1,695 million board feet in 1962, to 2,501 million board feet in 1980, to 4,033 million board feet in 2000, and finally to over 5,000 million board feet in 2020 (Figure 5). The timber cut in growing stock by the 19 subareas is shown in Table 6.

As long as net annual growth exceeds cut, timber inventories will

1/ "Timber Trends in the United States", Forest Service, U. S. Department of Agriculture - Forest Resource Report 17, February 1965.

TIMBER CUT WILL EQUAL TIMBER GROWTH IN BOTH GROWING STOCK AND SAWTIMBER BY 2020

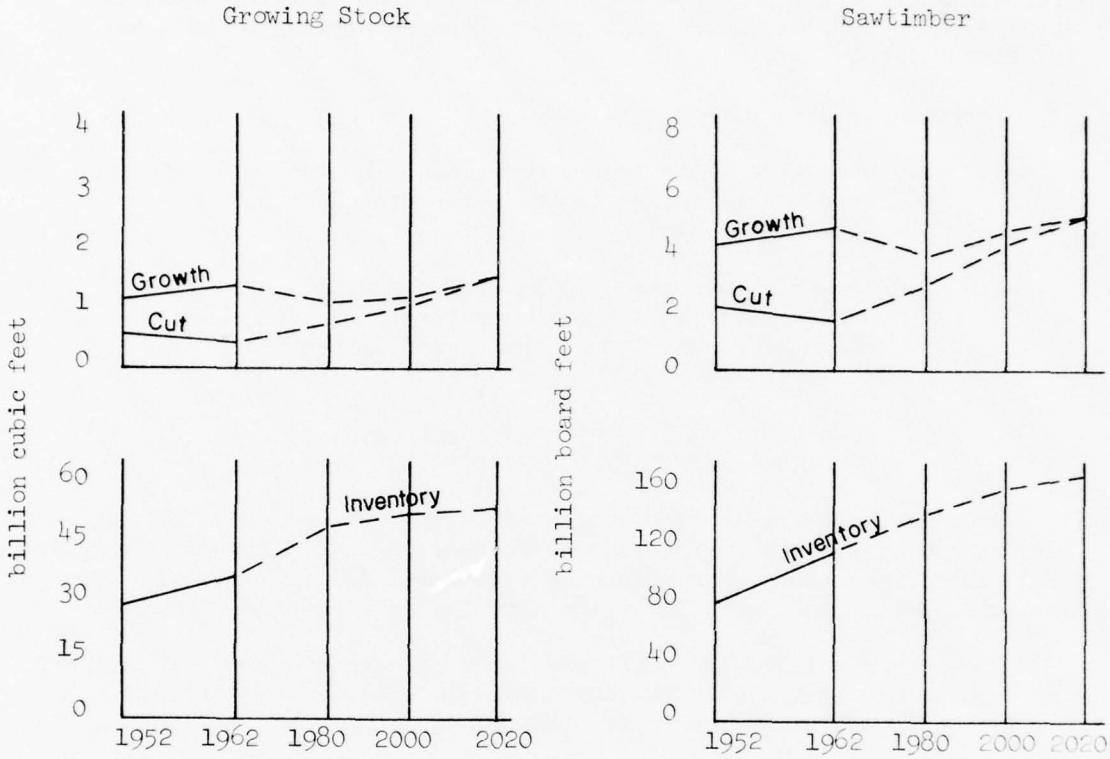

Figure 5

continue to increase. Inventories continue to build up through the projection years (Figure 5). In 2020, growth and cut volumes in growing stock volume are expected to be equal and timber inventories will not increase. Growing stock inventory at that time is estimated at 50.7 billion cubic feet in all species. Within this figure the sawtimber inventory will be 149 billion board feet. Table 8 shows timber inventories in growing stock for the 19 subareas.

Table 7 shows the timber products output for the projection years for sawlogs, veneer logs, and minor industrial products; for pulpwood; and for fuelwood. Production of pulpwood shows the largest increase in cubic feet of volume produced (Figure 6). Fuelwood production steadily declines.

Value: It is estimated that stumpage values in the Ohio River Basin will be 89 million dollars in 1980, 217 million dollars in 2000 and 444 million dollars in 2020. An estimate of the value of finished products of the timber resources is again based on figures in "The Economic Importance of Timber in the United States," cited above. Values would approximate 2.2 billion dollars in 1980, 5.4 billion dollars in 2000, and 11.0 billion dollars in 2020.

Most water used in processing may be recirculated in the mill, but finally returns to the stream in the effluent. Following are B.O.D. values for effluents from different pulping processes and that from municipal sewage for comparison:

Process	Approximate B.O.D. 1/
Groundwood pulping	3-8
Kraft (sulfate) pulping	55-70
Chemimechanical (cold soda) pulping 2/	50-100
Semichemical (neutral sulfite) pulping 2/	125-275
Sulfite pulping 2/	400-600
Municipal sewage 3/	167

There are now nine primary pulpmills in the Basin. These are all integrated with paper manufacture. The location by subareas and capacities of these mills are as follows:

Subarea	No. Mills	Total 24-hour capacity (Tons of pulp)
Allegheny.....	1	235
Ohio-Cincinnati.....	1	95
Scioto.....	2	400
Little Miami-Great Miami...	1	60
Muskingum.....	1	120
White.....	1	100
Wabash.....	2	175
Total	9	1,185

SOURCE: FS Data

Actual production of these mills will approximate 88 percent of capacity or 1,040 tons of pulp per day.

In addition to the above, there are roughly 40 secondary mills that use either processed pulp or purchased paper for raw material. Most of these require substantial quantities of water for processing and pollution control.

One cfs of water per ton of pulp production, including water supply

1/ In terms of pounds of oxygen per ton of pulp, unless otherwise noted. The lower value for the chemical and semichemical pulps is for pulp not made for bleaching; the higher value is for the bleachable grade.

2/ Without chemical recovery.

3/ Per 1,000 persons.

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2/ Without chemical recovery.

3/ Per 1,000 persons.

and adequate residual disposal was used to determine water requirements for the primary pulp and paper industries.

	Water Requirements (Billion gallons)
Present	340
1980	685
2000	1,520
2020	2,400

Secondary industries will also require additional quantities of water for manufacture and adequate pollution control.

Based on Appendix B, Projective Economic Study, Table II - 6 - "Output by Industry" - over 60 percent of the pulp, paper, and allied products (S.I.C. Group 26) is expected to be produced in the Scioto, Little Miami-Great Miami, and White Subareas by 2010. The Wabash, Ohio-Cincinnati, and Ohio-Louisville will account for 22 percent by the same year. Small outputs will occur in the remaining subareas except the Kanawha-Little Kanawha, Ohio-Huntington, and Guyandotte-Big Sandy-Little Sandy, which are not expected to have production. Major water requirements for these industries may be expected to follow this pattern and are included in Appendix D.

Projections of increased production of crops and livestock, most of which will be processed in the Basin, indicate a growing demand for water by the processing industries. However, it is assumed that these demands are included in the demands for industrial water supply. More research is needed to quantify this demand.

Other

The ratio of Federal ownership to the gross area within Forest boundaries ranges from a low of 8 percent in the Wayne National Forest to a high of 65 percent in the Allegheny National Forest (Table 27). (The Cherokee and Pisgah National Forests and Yadkin Purchase Unit were excluded from this analysis because of the very small areas involved.)

Future land use adjustments may also indicate the need for National Forest boundary extensions or the establishment of new purchase units. The need for consolidation of ownership within the present National Forest boundaries is due to a limited purchase program in recent years, resulting in many small and scattered ownerships. Table 27 indicates desirable National Forest net area in the projection years.

VI - PRESENT STATUS OF WATER AND RELATED LAND RESOURCE DEVELOPMENTS

Land Treatment Measures and Management Practices

The use, treatment, and management of all lands in the Basin have pronounced effects on the water resource as the land is the base on which the upstream watershed program is built. Land treatment measures reduce erosion and runoff. The downstream effect is the reduction of floodwater storage and sediment delivery rates. It also improves water quality for human use. Drainage developments for the removal of excess water allows more efficient use of land for food and fiber production. Supplementing the natural rainfall through irrigation during periods of deficient rainfall enhances the growers opportunity to maintain yields at a desired level and obtain a reasonable income on investment.

About 98 percent of the Basin area is in soil and water conservation districts. These districts are organized under State and Commonwealth laws and are governed by local people. Assistance is provided to farmers, ranchers, and other land owners in planning and applying conservation management and land treatment measures on their land. As of July 1, 1965 the districts provided assistance in the preparation of 162,877 basic conservation plans in the Basin. Their goal is "To use each acre of land within its capabilities and to treat it according to its needs." More efficient farm operations, higher incomes, and watershed protection result from this program of improvement. Some of the more common management and treatment measures emphasized by soil and water conservation districts are contour farming of all types, controlled grassland farming, and improved forest management and utilization.

Those practices which reduce erosion and runoff rates and the amounts that had been applied as of July 1, 1965 follow:

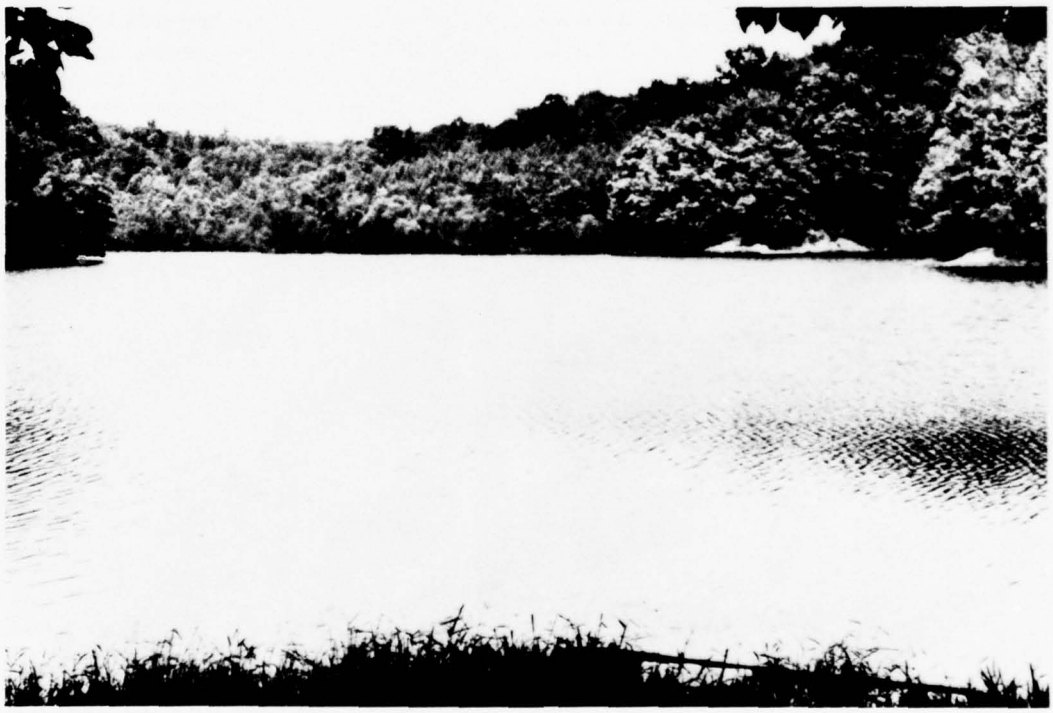
Practice	Unit	Amount on the ground
Conservation cropping systems	Acre	8,815,731
Contour strip cropping	Acre	721,972
Terraces	Miles	13,100
Diversions	Miles	7,643
Tree planting	Acre	692,756
Forest improvement*	Acre	1,228,674
Pasture and hayland planting	Acre	4,732,230
Pasture and hayland renovation	Acre	3,884,968
Critical area planting	Acre	70,932
Wildlife habitat development	Acre	264,198
Contour farming	Acre	1,409,258

* Includes: Woodland harvest cutting, intermediate cutting, interplanting, pruning, and thining.

Contour stripcropping to reduce erosion

Strip mining for coal occurs in 145 counties in 9 States or Commonwealths and in 16 of the 19 major subareas. At present, the total area disturbed by this type of mining approximates 743,000 acres. In addition, an estimated 50,000 acres are involved in associated coal-haul roads. In many areas, particularly the steep Appalachian Mountain regions, these roads cause runoff, erosion and sedimentation problems.

In recent years most of the States and Commonwealths have enacted laws to require the rehabilitation of strip-mined areas. These laws vary considerably in their requirements and enforcement, but have resulted in some progress. Also natural vegetation has healed or partially healed some areas - particularly areas disturbed by early operations.



Rehabilitated strip-mine area.

Many forest industries practice good forest management on industrial holdings. Cutting usually follows approved cutting practices, and some forest stand improvement may result. Fire protection is usually the responsibility of a State Forester in cooperation with the U. S. Forest Service, but some owners may construct firebreaks and provide additional protection.

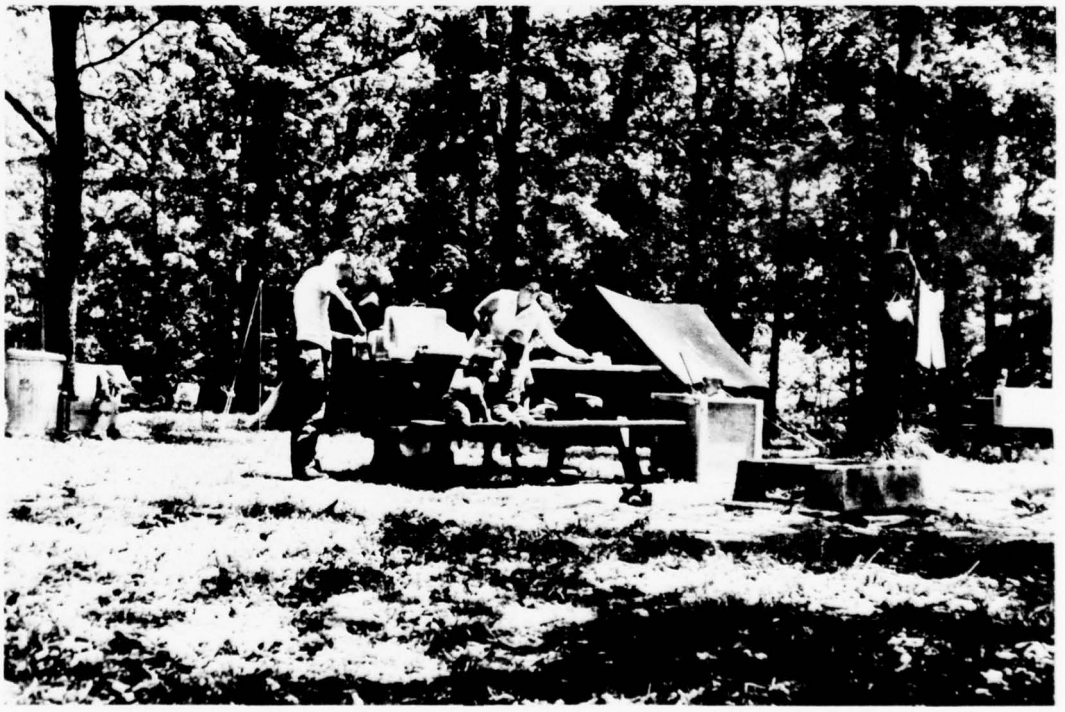
On State forests timber is harvested by approved cutting practices. Forest stand improvement is carried out, and a program of forestation is conducted where needed. Recreation, water, and fish and wildlife

management are integrated with timber management and livestock grazing is not permitted. Fire protection is generally adequate.

State foresters in cooperation with the U. S. Forest Service provide technical forest management assistance to private land owners. However, most land holdings are small and are producing from only one-third to one-half their capacity.

Military agencies administer commercial forest lands. These include military bases, arsenals, depots, and other tracts. Some of these agencies carry out timber and other resource management programs.

The 10 National Forests and purchase units located entirely or partly within the Basin are administered under the Multiple Use and Sustained Yield Act of June 12, 1960, and managed for the renewable surface resources of timber, recreation, water, and fish and wildlife. Most of this National Forest land was purchased under the Weeks Law and subsequent legislation during the 1930's. The Land and Water Conservation Fund Act of 1965 provides for acquisition of land for outdoor recreation purposes. Considerable area is being added to the National Forests through this program.



National Forest facilities provide opportunities for outdoor recreation.

The present status of National Forest lands is shown in Table 27. Through management timber species, volume, stocking, size and quality have been improved.

Federally owned lands administered by the National Park Service approximate 63,222 acres in ten sites and in six of the subareas. Mammoth Cave National Park is by far the largest with 51,351 acres of Federal land. Forest management in this Park is limited to that which enhances the recreation resource. No timber is cut for sale. Cultural practices are limited to the removal of dangerous trees in areas visited by people. Tree planting is done for erosion control only, and livestock grazing is not permitted.

Approximately 380,000 acres of Federal land are administered by the U. S. Army Corps of Engineers around their reservoir and navigation projects. Much of this is in noncommercial forest land and is not managed for the sale of timber. Large acreages of these lands are leased or put under agreement with the several States for use in State parks.

State, county, and municipal parks are usually intensively managed for recreation. No commercial cutting of timber is permitted on these lands.

While of no significant value from the timber standpoint, these noncommercial forest lands do contribute substantially to the water and wildlife resources in addition to recreation and natural beauty.

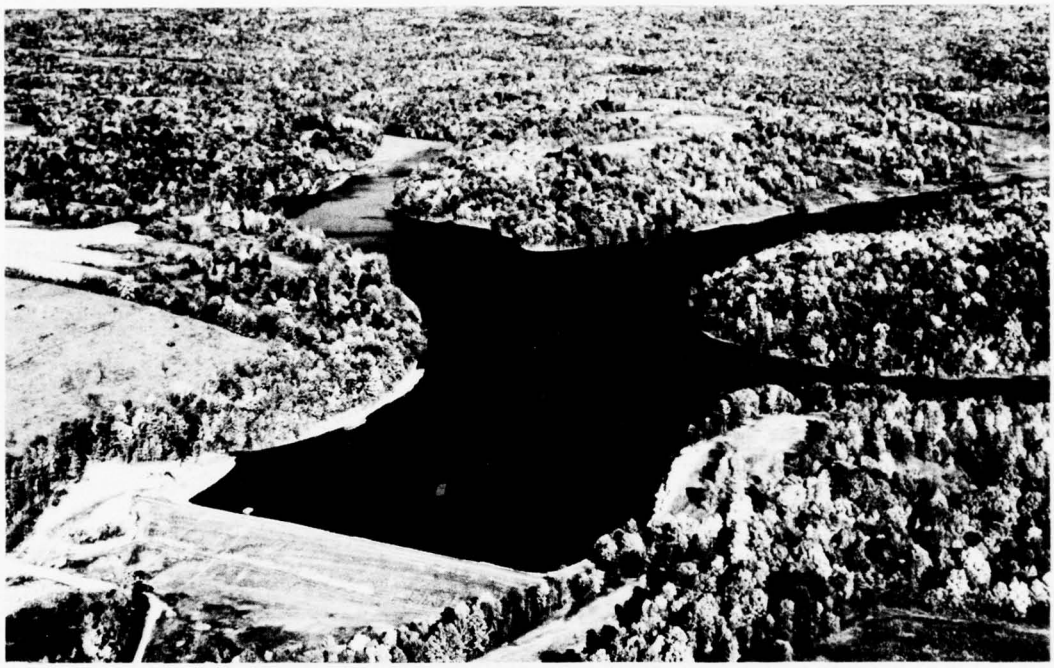
Flood Prevention

Seventy-four watershed projects have been authorized for construction, primarily for flood prevention (Plate 5). These projects are in different stages of development; some are constructed, others are in varying stages of completion, and others undergoing pre-construction planning and design (Table 28).

The works of improvements include 961 miles of channel improvements and 440 floodwater retarding structures which store 44,036 acre feet of sediment and 284,204 acre feet of floodwater (Table 29). The installation of these measures provide protection to 205,045 acres of upstream floodplain land. Rural-fringe and urban areas are provided a high level of protection when economically feasible. The flood damage reductions benefits attributed to these projects amount to $2.6 million annually. This shows a 4.6 percent reduction when compared to the total upstream flood damages. The average annual damage as modified by authorized watershed projects is estimated to be $53.1 million. More than 51 percent of this remaining damage is to crop and pasture lands while 26 percent is to urban areas (Table 20).

Irrigation

Approximately 30,000 acres of specialty crops are presently being irrigated. Of these acres 25 percent are located in the Wabash Subarea and 17 percent are in the Licking-Kentucky-Salt. The remaining acres



Upstream watershed developments will provide flood protection and water storage for other uses.

are somewhat evenly distributed throughout the other subareas. In addition to the specialty crops, it is estimated that about 20,000 acres of field crops are irrigated annually. See Table 22 for the distribution of present irrigation acreages.

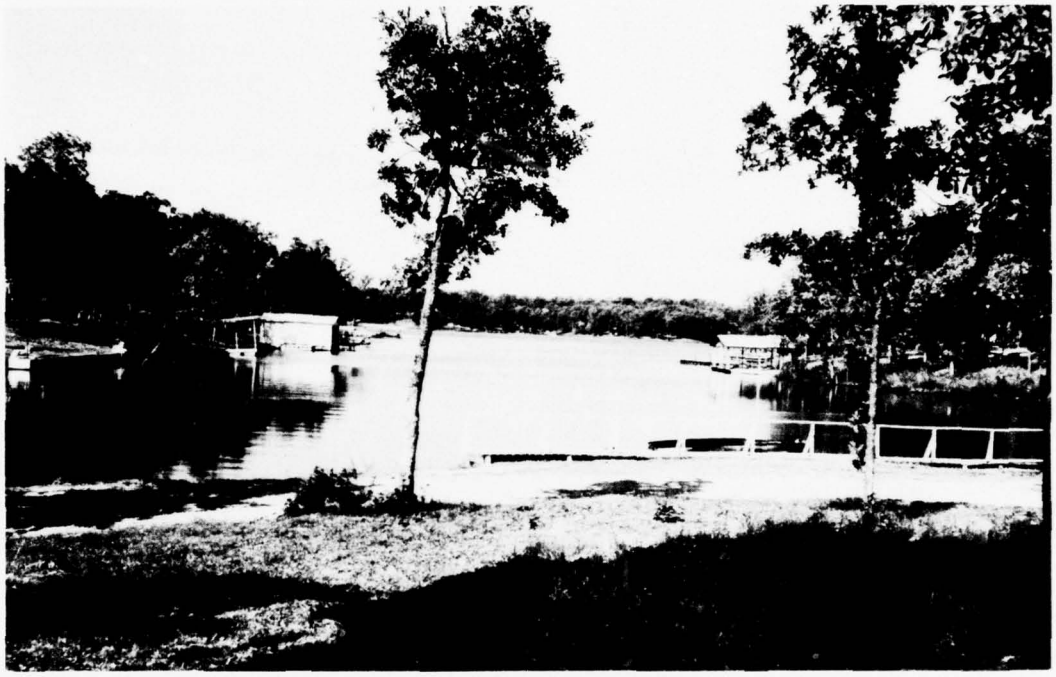
Agricultural Drainage

Around 11 million acres have been drained. This is 66 percent of the Basin's area showing economic potential for drainage development. Table 24 shows the present status of drainage by subareas.

Recreation

Watershed projects authorized for operations by July 1, 1965 include additional storage and development for recreation including fishing. These developments encompass 4,899 acres of water surface and 10,760 acres of adjacent land surfaces which accommodate 765,529 recreation days 1/. For a summary of multiple purpose developments, including recreation, in authorized watershed projects see Table 30.

1/ Recreation Day - A standard unit of use consisting of a visit by one individual to a recreation development or area for recreation purposes during any reasonable portion or all of a 24-hour period.



Lake and recreational facilities.

Opportunities for incidental recreation are available in the 388 single purpose flood prevention structures. They vary in size from a few acres to lakes of 100 acres. These reservoirs provide for convenient local recreation where a few hours of leisure time can be spent after working hours. Recreational use and access varies according to the easements or water rights provided. Recreation may include fishing, boating, water skiing, swimming, picnicking, hiking, and hunting depending upon size of surface area, availability of surrounding lands, and management. These structures can provide up to 1.1 million recreation days for incidental recreation. The P.L. 566 projects are primarily for flood prevention and are installed on both private and public lands.

Income producing recreation enterprises numbering 1,064 have been installed. Approximately 162,000 farm ponds have been built and are used intensively for recreation. It is further estimated that these ponds provide 75,000 acres of water which would supply 10.5 million recreation days.

The status of water and related land resource developments on National Forest land is shown in Table 31. Many of the improvements that impound water adjacent to National Forest land have been built by other Federal, and State agencies, municipalities, etc. The 1,000 acres of related land has been developed primarily for water oriented recreation such as camp and picnic sites, beaches, boat docks, etc. There have been some developments for the wildlife and fish resources.

Farm pond recreation.

The National Forests have developed other, nonwater oriented recreation facilities. These include horse and hiking trails, camp and picnic grounds, upland and big game hunting facilities, scenic roads, wilderness and wild areas, winter sports, sightseeing, and others. They accommodated some 3,456,000 visits in 1964. The Mt. Rogers National Recreation Area of the Jefferson National Forest, lies partly within the Basin and is of national significance. The Basin contains excellent but limited high quality free flowing streams. These provide important opportunities for fisheries and "wild river" type recreation.

Fish and Wildlife

Fish and wildlife has been included as a purpose in 12 of the authorized watershed projects. Approximately 4,478 acres of water surface and 10,638 acres of land area were designated for this use. These areas afford 385,406 recreation days in terms of hunting and fishing. Table 30 shows fish and wildlife opportunities in authorized watershed projects.

The estimated 162,000 farm ponds usually are well stocked and managed for fish production. These ponds are located on private lands and managed by the individual owner primarily for family and friends' use. However, some are open to public use and also make a significant contribution to this sector. In addition farm ponds play an important role in furnishing water for wildlife use.

The wildlife resources are significant. Much of the private lands support good game populations. Some of the private lands are managed as hunting preserves. Land treatment practices recommended for wildlife cover and habitat are being installed.

Planning for and the development of the fish and wildlife habitat resources are carefully considered on the National Forests. To date, some 824 ponds and water holes have been constructed on these lands. Fishery habitat in some streams has been improved.

Wildlife pond.

Water Supply

Rural Community - Domestic and Livestock: Springs and wells are the principal sources of water for farm and rural nonfarm domestic and household use. The present supply is adequate in most areas. There are about 750,000 households presently pumping an estimated 330 million gallons per day in the rural areas. There are approximately 25,000 spring developments installed on the farms.

Farm ponds are used for watering livestock. The 162,000 ponds are now supplying the demand for surface storage. These ponds have an aesthetic appeal as well as tangible benefits including use in fire protection. Some P.L. 566 flood detention structures provide some

emergency upstream water supply from sediment pools.

Farm pond for water supply and recreation.

Municipal and Industrial: Of the 74 authorized watershed projects, 12 have water storage for municipal and industrial uses included. The reservoirs were designed to store 11,888 acre feet for this use. These developments were sponsored and financed by local organizations.

Water Quality Control: There were no water storage developments for quality control included in the authorized watershed projects as of July 1, 1965. However, the combination of sediment retention in floodwater retarding structures and the effect of land treatment measures materially reduce downstream silt pollution. As stated previously 44,036 acre feet of storage capacity is provided for sediment in the authorized projects.

In the administration of National Forests, water quality is carefully considered in resource management. As a result some 2,207,000 acres of these lands are contributing to higher quality water yields in the Ohio River Basin. Progress has been made in arresting sheet and gully erosion and reducing sediment yield. Strip mine areas have been revegetated or reforested and the effects of acid mine wastes have been reduced.

VII - WATER AVAILABILITY IN UPSTREAM AREAS

Surface

Quantity. Precipitation is the source of all water supplies. The average annual precipitation is 36 inches in the north, 52 inches in the south and more in local areas of the eastern mountains of the Ohio River Basin 1/. The Basin's average annual precipitation of about 44 inches is well distributed throughout the year. The distribution of precipitation by months for four Weather Bureau Stations is as follows:

Percent of Average Annual Precipitation by Months

Sta. 2/	J	F	M	A	M	J	J	A	S	O	N	D	Average Annual Precipitation
A	7.7	7.2	8.8	7.9	9.6	11.8	12.2	9.3	6.7	6.6	5.9	6.6	45.98
B	10.6	9.3	11.5	9.1	8.2	8.4	8.6	6.9	6.6	5.5	7.1	8.2	46.28
C	7.4	6.2	9.6	9.1	9.9	10.2	9.1	8.4	8.7	6.4	7.9	7.1	39.69
D	7.7	6.8	8.9	8.6	9.3	11.0	11.6	9.5	6.8	6.5	6.2	7.1	36.26

SOURCE: Climatological Data, U. S. Department of Commerce

Records of the U.S.G.S. stream gage on the Ohio River at Metropolis, Illinois, indicates that an average annual runoff of 17 inches passes the city from the Ohio Basin. This is 40 percent of the average annual precipitation and a source of water which should be managed for more beneficial uses.

Upstream land use and treatment practices affect the surface runoff and ground water recharge. While the total yield at a given point may not be materially affected, surface runoff rates can be changed significantly.

1/ Appendix C - Hydrology, Ohio River Basin Comprehensive Survey, Plate 8.

A 2/ Elkins, West Virginia

B Nashville, Tennessee

C Indianapolis, Indiana

D Pittsburgh, Pennsylvania

Seasonal runoff is an important upstream consideration. The average monthly runoff in percent of annual runoff for four locations typical of the upstream watersheds with 400 square miles or less of drainage area is as follows:

Sta. 1/	Percent of Annual Runoff by Months												Average Annual Runoff Inches
	J	F	M	A	M	J	J	A	S	O	N	D	
A	14.1	13.0	15.8	11.5	10.5	5.7	4.8	4.0	2.0	3.4	5.3	9.9	26.7
B	18.7	18.6	18.0	11.6	6.8	3.9	2.5	1.1	1.6	0.8	5.0	11.4	19.9
C	12.7	12.1	13.9	13.9	11.6	10.4	5.7	3.4	2.4	2.9	4.4	6.6	13.5
D	13.0	11.7	17.8	14.8	10.3	5.4	3.3	2.2	1.6	2.8	5.3	11.8	22.2

SOURCE: USGS Water Supply Papers 1305 and 1725

Methods and procedures for upstream runoff determination are discussed in the Hydrology Appendix, Section 15(e).

Surface water storage facilities in the upstream areas include farm ponds; watershed protection projects including both multiple purpose developments and sediment pools; and other storage in commercial or small urban reservoirs.

Following is the approximate distribution of these supplies in percent of the total:

A 1/ Tygart River at Bellington, W. Va., near Elkins, W. Va., 53 years of record, drainage area 408 square miles.

B South Fork of Little Barren River at Edmonton, Ky., 18 years of record, drainage area 181 square miles.

C Fall Creek at Fortville, Ind., near Indianapolis, 19 years of record, drainage area 172 square miles.

D Sugar Creek at Sugar Creek, Pa., near Pittsburgh, 28 years of record, drainage area 166 square miles.

	Storage Sites	Storage Volume	Surface Area
	----------	Percent	----------
Ponds	98	60	90
Watershed Protection	1	38	9
Other Storage	1	2	1

Farm ponds provide 75,000 acres of surface area and 200,000 acre feet of storage for agricultural purposes. There are an estimated 1.5 million additional sites suitable for farm pond construction. The development of this potential for domestic and livestock water will depend on the availability and cost of ground water supplies.

Agricultural water supply storage.

Water storage sites were inventoried for multiple purpose use with flood prevention as the primary consideration. Individual purpose needs may be met by different combinations or locations of sites.

Following are the number of sites and available storage for all purposes in those inventoried:

Status	Sites	Average Drainage Area Per Site	Average Water Surface Area	Total Available Storage
	(No.)	(Square Miles)	(Acres)	(Acre Feet)
Authorized projects	440	4.2	39	413,000
Potential projects 1/	2,930	6.3	147	13,763,700
Off project sites 2/	3,307	5.0	115	12,946,000
Ohio Basin Total	6,677	5.5	124	27,122,700

SOURCE: Tables 29, 32 and 33 of this report

The lack of specific amounts and location of other needs limited site selection for beneficial purposes other than flood prevention. However, the data presented should be adequate for a general assessment of water availability for irrigation, recreation, and supply for municipal and industrial uses, and quality control. Further study will be required to define needs for specific developments in all purposes.

The inclusion for other purposes in authorized watershed projects of 11,888 acre feet for municipal and industrial water supply and 9,377 surface acres or 72,942 acre feet of recreation, including fish and wildlife, water are indicative of the local interest in meeting these needs from surface storage. Recent amendments to P.L. 566 such as the inclusion of recreation and fish and wildlife have stimulated activity in multiple purpose developments. Increased storage limitations for flood prevention to 12,500 acre feet have also had beneficial effects on these developments.

Stream flows in the upstream areas are unpredictable. Streams draining 10 to 100 square miles are sometimes classed as intermittent. This means that in drought years the flows are insignificant and in normal years may not be sufficient for irrigation or downstream pollution abatement. More specific study will be needed to determine the availability of stream flow and the effects of water removal on the production of aquatic resources. Maximum and minimum runoff in inches for typical upstream areas by months are as follows:

1/ Watershed projects that are potentially feasible for development under present P.L. 566 type criteria.

2/ Resource development potential in watersheds which do not appear to have project potential under present P.L. 566 type criteria.

Runoff in Inches by Months

Location*	J	F	M	A	M	J	J	A	S	O	N	D
(A) Max.	8.11	4.36	3.75	4.21	4.97	5.76	2.43	2.72	.93	1.50	2.20	3.70
Min.	.17	.43	.62	.65	.48	.27	.23	.07	.05	.15	.21	.27
(B) Max.	9.86	4.95	6.64	5.79	5.49	3.60	3.71	2.37	1.66	2.75	3.39	4.93
Min.	.77	.53	2.27	.95	.44	.28	.14	.15	.10	.16	.22	.54

SOURCE: USGS Stream Gage Data

Maximum and minimum annual yield in inches from typical upstream areas follows:

Location*	Year of Record	Maximum and Minimum of Record (inches)
(A) Max.	in 1950	44.64
Min.	in 1944	3.60
(B) Max.	in 1937	55.14
Min.	in 1934	6.55

SOURCE: USGS Stream Gage Data

Quality: Quality of the surface stored water in upstream areas is usually adequate for general use, but silt, chemical and bacterial pollution occur. Proper land use and treatment contributes measurably to the quality of surface water supply.

Many of the forest covered soils are shallow and quite erosive. This is particularly true in southern Illinois, southern Indiana, and western Kentucky. The eastern portion of the Basin is characterized by very steep topography, and many of the soils found here are shallow. For these reasons, the erosion potential is high in these areas requiring careful management.

Forest cover can contribute much to the maintenance of desirable hydrologic conditions and influence of storm runoff in watersheds. Good

* (A) Fall Creek at Fortville, Indiana, near Indianapolis, Ind., 19 years of record, drainage area 172 square miles.

* (B) Sugar Creek at Sugar Creek, Pa., near Pittsburgh, Pa., 28 years of record, drainage area 166 square miles.

hydrologic conditions have the effect of decreasing flood peak discharge and sediment production. The degree that these forests do contribute to the hydrology is dependent on their extent and condition as a result of past use and management. The land area of the Basin is 40 percent forest covered - ranging from a low of 10 percent in the Wabash and Little Miami-Great Miami to 82 percent in the Guyandotte-Big Sandy-Little Sandy Subareas. Stocking of forest trees is generally satisfactory in the overall Ohio River Basin. Over 25 million acres of the 41 million acres of commercial forest land have stocking of more than 70 percent.

Ground Water

Ground water is the source of supply for most of the household and much of the livestock water supply in the agricultural areas. Some agricultural based industries as well as irrigation and small communities have local needs supplied by ground water from wells or springs. Rural fringe areas secure most of their water supply from wells. Increase in rural nonfarm populations will be an additional draft on the upstream ground water supply.

Most locations can provide household water needs from some aquifer. The Basin has much untapped ground water.

Conjunctive development of ground and surface storage should be studied on a regional basis as the ground water recharge source may not be at the point where the need exists. Consideration should be given to aquifer recharge potential and quality improvement of recharge waters in the planning of upstream reservoirs and channel improvements.

Ground water quality is quite variable by location, depth and strata tapped. General lack of bacterial pollution, low turbidity, and relatively constant mineral content and temperature are expected in ground water. Treatment to reduce mineral content for household purposes is necessary throughout the Basin, however, most ground water sources pose no problem for agricultural use. Iron concentrations are high throughout the Basin and carbonates, clorides or sulfides may be local problems. Silt and surface contamination is to be expected in wells and spring flow in the cavernous limestone areas.

Appendix E - Ground Water Distribution and Potential in the Ohio River Basin - gives a more detailed accounting for each of the subbasins. Relatively small amounts of specific data for the upstream ground water supply are found in Appendix E. The Reports on Ground Water Investigations published for specific areas in the States are indicated on Plate #2 of Appendix E.

The following discussion relating to ground water supplies throughout the Basin is in order of their estimated potential for upstream development. The range in pumping rate of the major source of ground water and its general upstream availability are taken from Appendix E for the areas indicated.

Ground water supplies in the Scioto River Subbasin have the greatest potential for development. The aquifer could possibly be used as a

large detention reservoir. Recharge and quality control should be considered in all sites. Yields north of Chillicothe should exceed 20-150 gpm in either glaciated material or bedrock at depths of less than 225 feet. South of this point yields are less than 20 gpm at depths from 75-750 feet.

The Great Miami and Little Miami Subbasins appear to have the highest yielding sources of ground water supplies in the Ohio River Basin. Aquifer recharge may be necessary for maximum industrial and urban use and should be considered in upstream surface developments in the northern glaciated two-thirds of the subbasins. Yields from 50 to 3,000 gpm may be obtained at depths of less than 200 feet in this area. From 10 to 100 gpm can be obtained at depths ranging from 50 to 200 feet in the southern part.

There are excellent ground water sources in all areas of the Wabash Subbasin, except north of the Wisconsin-Glacier Line. Some hardness and iron may require treatment as the major source is from glacial outwash strata. The total storage as indicated by dry weather discharge into the streams is expected to be high. Regional uses should be considered. Pumping yields will exceed 100 gpm almost everywhere at depths of less than 300 feet. Deep wells in the southern part of the subbasin yield to 400 gpm from depths to 700 feet.

The valley of the Ohio River has excellent potential for future development. The Beaver and Upper Ohio River areas have good potential, but not for high use or concentration. Calcium carbonate and iron concentrations will require treatment. Yields from high capacity wells along the Ohio River have ranged to 1,500 gpm at less than 100 feet of depth. Sandstone aquifer yields in the Beaver range from 20-300 gpm at less than 350 feet of depth.

The Muskingum and Hocking Subbasins are in one of the better regions for development with little treatment for quality necessary. There are intensive developments at points of need, but the overall upstream ground water resources are relatively untapped. In the northwestern half of the subbasins, at depths up to 500 feet, yields from 100 to 3,500 gpm have been obtained. The southeastern half of the subbasins yields from 5-50 gpm at the same range of depth.

In the Little Kanawha and Kanawha Subbasins ground water supply from river alluvium has considerable potential for future development, with yields to 1,500 gpm at less than 100 feet. Upstream supplies in sandstone aquifers in central and eastern West Virginia are good, with yields from 100-600 gpm at less than 600 feet. North Carolina and Virginia waters may need treatment. The Little Kanawha and an area northeast from Hinton in the Kanawha yield less than 50 gpm at less than 250 feet of depth.

Significant supplies yielding 100-500 gpm of suitable quality are available in the Guyandotte, Big Sandy and Little Sandy Subbasins. Principal source areas are the southern main valleys sandstone formations

at depths of 100-400 feet. Upstream yields in the Guyandotte, Little Sandy and the northern half of Big Sandy of 20 to 40 gpm are expected at similar depths. The adjacent Ohio River Valley has large supplies for potential use.

The major ground water source location in the Monongahela Subbasin is along the eastern mountainous area and the Monongahela and Youghiogheny Rivers. Almost any area can supply 20-300 gpm at less than 300 feet of depth. Surface contamination by mines is a problem in alluviums.

Yield is good in all valley fill material and most rock formations of the Licking and Kentucky Subbasins. Calcium, sodium, or sulfide is present in some excessive degree in most waters. In the Kentucky Subbasin pump yields of 20-500 gpm have been found at less than 500 feet of depth. Springs yield up to 900 gpm. The upstream areas of the Licking River will generally yield less than 20 gpm from massive limestone formations to depths of 500 feet.

Water is available in quantities, but not quality in the Allegheny Subbasin. There is limited potential development, except in the main Allegheny River Valley. Ground water from the sandstone stratas in the southern two-thirds of the subbasin generally yield up to 100 gpm to individual wells. The Glacial Moraines of the northern one-third of the subbasin generally yield equally well at a similar range of depths to 500 feet.

The Salt River Subbasin has low potential ground water supplies with upstream well yields of less than 20 gpm expected. The Green River Subbasin has tremendous springs issuing from the limestone formations, while the western coal field sandstones produce high yields to wells. Wells in the Green Subbasin may be unpredictable and saline water is encountered at 75 feet of depth in some areas. Potential supplies are adequate for most needs, with yields exceeding 20 gpm at less than 200 feet of depth. Rather deep wells in upstream areas and shallow wells in the river valley alluvium may produce 600-1,500 gpm. Alluvium along the adjacent Ohio River Valley has excellent potential for development.

Ground water yields in both the eastern and western regions of the Cumberland Subbasin are adequate for moderate development. However, this subbasin generally has the least potential for future development in the Ohio River Basin. Well depths of less than 300 feet can produce from 20-100 gpm.

VIII - LAND AVAILABILITY

A partial accounting for water and related land resource development needs indicates that considerable pressure will be brought on the region's land base within the projection period. Land may not be available to satisfy projected requirements soon after 2000 (Tables 34, 35 and 36). The indicated shortage appears to be most critical in the Licking-Kentucky-Salt, Cumberland, Kanawha-Little Kanawha, White, and Guyandotte-Big Sandy-Little Sandy Subareas. More intensive and detailed study is needed to adequately evaluate the impacts of all resource development and establish multiple use patterns. Likewise, additional study of the productive capacity of other regions of the Nation will be needed to determine whether or not some of the projected requirements for the Ohio Basin can be satisfied in other areas. Present and projected land requirements are as follows:

	1959		2020	
	----1000 acres-----			
Cropland	25,089		22,325	
Pasture	16,350		20,317	
Forest	40,789		42,000	
Urban & Built-up	4,915		9,675	
Other	7,012	1/	14,924	3/
Total Land Required	94,155	2/	109,241	
Total Land Area	103,281		103,281	

Land Required to Meet Economic Demands

Cropland and Pasture: Estimated future needs for crop and pasture land in the projection years are based largely on projected national requirements for food and fiber. The quantity of land needed is also dependent on crop yields and intensity of land use. Both crop yields and land use are affected by resource development measures such as

1/ Includes land areas used for farmsteads, rural nonfarm residences, crossroad commercial areas, rural schools and churches, wastelands, etc.

2/ In addition, there were 9,126 acres classed as cropland or pasture but not used.

3/ Includes:

a. Land areas used for farmsteads, rural nonfarm residences, crossroad commercial areas, rural schools and churches, wastelands, etc. - Not considered available for resource development

b. An incomplete accounting of areas needed for resource development (water and land) for recreation, fishing, flood prevention, and water supply for various uses.

Proper use and protection improves the land resource.

flood protection, drainage and irrigation. Land use becomes more intensive and crop yields are increased by application of these measures. Consequently, production requirements can be satisfied on smaller acreages. Projected requirements for the Ohio Region for 1980 could be met with 37 million acres of crops and pasture if resource developments were held at present levels. With maximum application of flood protection, drainage and irrigation, however, requirements could be met with only 31 million acres in crops and pasture 1/.

Since maximum adoption of development measures and associated management practices in the projection period is unlikely, levels of resource development somewhat lower than the maximum are projected (Tables 37, 38 and 39). Total acreage of cropland and pasture under the above assumptions is projected at 34.0 million acres for the Basin as a whole in 1980, compared with 41.4 million in 1959. This reduction in acreage is possible, because of technological changes in production and increased water resource development even though production requirements are projected to increase during the 1959-80 period. Moreover, production requirements can be met at lower per unit cost to farmers as a result of these developments.

Between 1980 and 2020, increasing acreages of cropland and pasture will be needed in spite of the expected improvements in technology and development. (Figure 7.)

1/ Agricultural Activity in the Ohio River Basin, 1980-2010: A Projective Study, May 1966.

Total Cropland and Pasture Needs, Ohio River Basin
1959-2020.

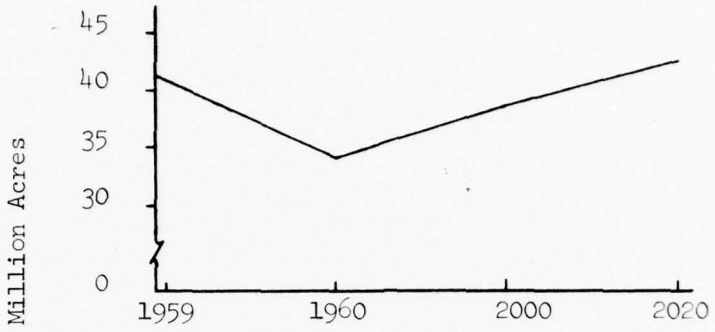


Figure 7

Important shifts in production are projected both within and among the various subareas of the Basin. From the present time to 2020, a steady upward trend in the acreage of food crops may be anticipated, rising from 6.1 to 8.3 million acres by 2020. A high proportion of the acreage of these crops will continue to be located in the Wabash, White, Scioto, and Little Miami-Great Miami Subareas. Larger increases in food crop acreage are more likely in the Scioto and Little Miami-Great Miami than in any other subarea.

Feed crops are projected to decline slightly and will constitute a smaller proportion of total cropland and pasture acreage. In 1959 these crops accounted for 26 percent of the total acreage utilized for crops and pasture and by 2020 they are expected to make up about 23 percent. Feed crop acreage has become concentrated in the Wabash and White Subareas. These two subareas have 48 percent of all the feed crop acreage at present, and are projected to account for 53 percent in 2020.

Roughage crops are expected to decline drastically throughout the projection periods, dropping from about 6 million acres in 1959 to only 3.4 million in 2020. Practically all of the subareas share in this decline but the change is especially great in the eastern portions of the Basin.

The acreage needed for pasture fluctuates during the projection years, dropping by about one-third from 1959 to 1980, and increasing steadily by 2000 and 2020. Miscellaneous crops are projected to decrease gradually from the present to 2020. The loss is relatively small, amounting to about 150,000 acres or one-eighth of the 1959 acreage.

Forest: Forest land acreage will continue to be lost to urban and suburban expansion; construction of highways, airports, impoundments; rights-of-way for power lines, utility lines and pipelines; and to other improvements. Additional forest acreage will go into crop and pasture land as irrigation, drainage or other developments make suitable

land available. On the other hand, forest land will gain in acreage as unsuitable crop and pasture land is returned to forest cover, as strip-mined lands are reforested, and as other land adjustments are made.

The net effect as projected in Tables 34, 35 and 36 would be a gain of over one million acres of forest land. This does not necessarily present a bright future for the forest land situation. In fact, much of the best bottomland and cove timber will be claimed by water resource development projects, both upstream and downstream. It is not uncommon to divert some of the best forest land into suburban developments. Much of the gain in forest land will be in reclaimed strip-mined and idle lands. This will not soon replace high quality forest land which is lost.

Available forest land can provide increasing supplies of wood, water, wildlife, and recreation benefits to meet demands, but only if properly developed and used.

Urban, Industrial and Related Purposes: Urban areas are expected to expand to provide home sites, service and industrial development. In rural areas, highways and recreation areas are expected to require more land. Land for these uses is likely to come from areas now devoted to agriculture and forestry. Diversion of farm and forest land to these uses reduces the potential of the land resource for production of food, fiber and timber products.

About 1.4 million acres more land will be required for urban uses in 1980 than in 1960, with an additional 3.4 million by 2020. Thus, the amount of urban land in 2020 will be 4.8 million more than in 1960. This represents 4.7 percent of the 103.3 million acres of land in the Ohio Basin.

It is not expected that related lands needed for forest based industrial plants will present any problems. Usually these are small acreages and are considered at the time that studies are being made on plant locations.

Strip Mines: The land required to meet projected surface coal mining demands is dependent on several factors. Coal demand is expected to increase about four and one-half times between 1960 and 2010 1/ in the Ohio River Basin, so coal will probably be strip-mined as long as economically feasible. With the development of larger equipment many acres of land have been strip-mined more than once. Remining of more areas will be made possible with additional advances in techniques and equipment.

It is estimated that an additional 500 thousand acres will be strip-mined by 1980. Haul-roads will require an additional 50 thousand acres. Section 205(c) of the Appalachian Regional Development Act of 1965

1/ Appendix B, Projective Economic Study, Ohio River Basin Comprehensive Survey, August 1964 - Appendix K-2 (page K-11).

declares the intent of Congress to provide for a study of a comprehensive, long-range program for the purpose of reclaiming and rehabilitating strip and surface mining areas of the United States.

Impacts of Water and Related Land Resource Developments

Total land and water area needs were not available for inclusion in this report; therefore, the full impacts of needed resource development cannot be assessed without further study or information. Requirements for upstream flood prevention, irrigation, drainage and rural water supply were determined by U.S.D.A. on a subarea basis. Those for recreation as determined by the Bureau of Outdoor Recreation are basin-wide. Other requirements that will have significant impacts on future land use are downstream flood control, fish and wildlife, municipal, industrial and quality control water supplies. Since all land needs data are not obtainable from all agencies, only the total basin aspects of that available will be discussed.

Flood Prevention: Single purpose flood prevention storage in upstream areas of the Basin is expected to require 102,000 acres by 1980; 256,000 acres by 2000; and 320,000 acres by 2020. The total upstream flood plain land area is approximately 3.0 million acres. About 56 percent of the flood plain lands are used for crop production. The distribution and flood plain land use by subbasins is shown in Table 19.

The approximate 1.9 million acres of flood plain lands within potential upstream watersned projects (Table 40) would be protected from the more frequent floods (3-5 years). A lesser level of protection from the larger storms (10-50 years) is also provided. An annual increase of $14.8 million could be realized from increased production and intensified land use on the flood plain area.

In addition to the July 1, 1965 program 1/, lands required for downstream flood control pools are expected to increase by 615,000 acres by 2020. Requirements for 1980 and 2000 were not made available.

Irrigation: Studies of projected costs and returns to irrigation indicate that relatively small increases in irrigation of field crops seem likely between now and 1980 (Table 22). Irrigation of fruits and vegetables is also expected to be profitable with a consequent increase in the proportion of these crops which will make use of supplemental water. Technological improvements and increased demands for food and fiber will make irrigation much more attractive to farmers by 2000. The acreages listed represent economic potentials irrespective of the source of water used for irrigation. It is expected that 1.2 million acres of field crops would be irrigated by 2020 if the economic potential materializes. In about half of the subareas, irrigation of field crops would not be important, but major increases in irrigation would be expected in the Wabash, White, Little Miami-Great Miami, and Scioto areas. Economic potentials will not be realized if water supply is unavailable or more costly than anticipated.

1/ Appendix M - Flood Control, Ohio River Basin Comprehensive Survey

Water requirements for irrigating this acreage would increase accordingly (Table 23). Land areas needed for irrigation water storage will be approximately 10,000 acres by 1980; 35,600 acres by 2000; and 65,000 acres by 2020.

Drainage: Projections indicate that approximately 4.3 million additional acres may be drained by 1980. Drainage of crop and pasture land has been an important source of increased farm production in the past and can be expected to contribute further to output in the future. Projections are based on budgeted costs and returns from drainage and associated management practices. The estimates for 1980, 2000, and 2020 in Table 24 may be regarded as the maximum acreage on which drainage would be economically feasible, assuming that limitations on capital, legal problems, and physical restrictions on off-farm channel improvements can be overcome.

Rural Community - Domestic and Livestock - Water Supply: Most of the lands required for this category will be in livestock water developments. Farm ponds are expected to be the primary source of this supply. About 47,000 acres are expected to be converted to farm ponds by 1980, 86,000 acres by 2000 and 112,000 acres by 2020.

Recreation: The Bureau of Outdoor Recreation estimates that under an average type of development, the Basin's recreation water and adjacent land requirement would be 2.2 million acres by 1980; 4.5 million acres by 2000; and 6.8 million acres by 2020. These areas could be greater or less, depending upon the intensity of development.

IX - NEEDS, PROBLEMS AND POSSIBLE SOLUTIONS AS RELATED TO AGRICULTURE AND AGRICULTURAL PROGRAMS

The U. S. Department of Agriculture has responsibility for assistance in solving water and related land problems in the Basin through its authorized programs for resource development. Watershed protection and management, flood prevention, outdoor recreation, fish and wildlife, municipal and industrial water supply, water quality, irrigation, rural community water supply - domestic and livestock and agricultural land drainage are specifically related to agriculture and agricultural programs.

Needs for outdoor recreation were determined by the Bureau of Outdoor Recreation; for fish and wildlife by the Bureau of Sport Fisheries and Wildlife; and for municipal and industrial supplies and water quality control by the Federal Water Pollution Control Administration.

Needs and Problems

Land Use, Treatment and Management: The efficient use of land and water is fundamental to the proper management of these resources. Establishment of necessary treatment measures on the land is also vital.

Erosion control and drainage are the principal conservation problems on cropland. There are significant areas of cropland throughout the Basin which should be converted to pasture or forest use. Proper establishment and management of pasture and forest to improve cover is the greatest need on these lands.

The National Inventory of Soil and Water Conservation Needs show areas of cropland, pastureland and forest which will need conservation treatment by 1975 (Tables 41 and 42). This inventory was made and reported on by States. Reports within the Basin were completed in 1962.

According to these reports land treatment needs on cropland on which the dominant problem is erosion will amount to 10.8 million acres. Type of measures needed are those that would provide a high degree of runoff retardation, reduction of sedimentation hazards that would adversely affect the installation, operation and maintenance of structural measures, and help in keeping soil losses within allowable limits. Cropland on which excess water is the dominant problem is expected to amount to 8.5 million acres. Unfavorable soil conditions in the plant root zone will be the dominant problem on 0.6 million acres.

Pasture land treatment needs by 1975 will include such measures as pasture planting on 4.5 million acres and improvement of vegetative cover on 12.2 million acres.

Forest land treatment needs for 1975 include planting trees on 4.5 million acres, improving existing timber stands on 17.3 million

Erosion depletes the land resource and contributes to stream and reservoir sedimentation.

acres, protection from livestock grazing on 7.4 million acres, intensified fire protection and control on approximately 22 million acres, protection from insects and disease on 9 million acres, and erosion control practices on 0.9 million acres.

By 1980 the demand for lumber and wood products is expected to double and that for pulp and paper products to increase seven-fold. These demands will put a severe test on the basic forest resources. At the same time, demands on the resource for forest recreation, wildlife habitat, and watershed protection and management are expected to increase tremendously.

Of primary significance to the above projections are the facts that (1) present hardwood sawtimber is generally poor in quality, and (2) about nine out of ten acres of the commercial forest land are owned by farmers or by miscellaneous private groups. As a whole, these groups do not manage their forest lands as well as those who manage the industry-owned or public-owned lands.

Many of these needs apply to lands owned by farmers, housewives, business and professional people, and wage earners--in all, up to 700,000 owners. Most of these forest landowners are devoting full time to other than multiple, or even single, use of their forest land. Many do not have enough timber individually to warrant hiring a forester,

even on a part-time basis.

Tnus there is a strong need to extend and intensify technical forestry service if demands for goods and services of forest land are to be met in the projection years to 2020. Unless there is considerable improvement in managing small forests, there is no reason to believe that the 1975 needs listed above will be met; and there is a special urgency here since forest goods and service demands cannot be satisfied by short-term measures. Also, pockets of rural poverty exist in many forested areas witnin tne Basin.

Management increases forest productivity.

On the one acre in ten of forest land that is industry or public-owned, there is also a need for stepped up effort even above the intensive management now practiced. For example, tne 5,168 surface acres of water and the 7,803 acres of related land on 9 National Forests within the Basin are inadequate in view of the unsatisifed demand of 105.4 million recreation visits in 1960. A projection of 971.3 million recreation visits in 2020 points to the urgency for minimum development of 77,575 surface acres of water and 55,650 acres of related land by 2020 witnin these National Forests (Table 43). There is a need for additional watershed protection and management in the headwaters of the Ohio River.

Works of improvement consisting of road and trail construction, rights-of-way for utility and transmission lines, pipelines, etc; mining; and urban and suburban development result in vegetative disturbances. Such works of improvement expose bare soil which is subject to sheet and gully erosion and accelerates problems of downstream sedimentation. Revegetative and other protective measures are essential to stabilize these areas.

Strip-mining for coal has left vast acreages of land denuded of vegetation and in a nonproductive capacity. It is estimated there are approximately 743,000 acres of land that have been stripped for coal production in the Basin (Table 15). Some of these lands have been stripped more than once. In addition to causing pollution by sedimentation, many of these areas contribute to acid pollution of the streams rendering them unfit for many uses. Access and haul roads associated with the mining operations also add to the problem. An additional 500,000 acres are expected to be stripped by 1980. Associated haul roads will affect an estimated 35,000 acres.

Flood Prevention: In addition to those damages reduced by the 74 authorized watershed projects there is a residual of $53.1 million annual flood damages in upstream areas. With no further water resource development, these are expected to increase to $68.3 million by 1980, to $90.9 million by 2000, and to $116.6 million by 2020 (Table 21). The amount and type of damages vary from subbasin to subbasin. Remaining damages are highest in the Wabash Subbasin ($16.1 million) and are the lowest in the Salt Subbasin ($0.24 million) (see Figure 8). They are on floodplains comprising cropland, pastureland, woodland, urban areas, and transportation facilities. Damages are primarily to urban areas and transportation facilities in the eastern portion of the Basin while they are more of an agricultural nature in the western portion. Table 20 shows both the amount and type of upstream damages by subbasins.

Irrigation: Irrigation land and water needs throughout the Basin are as follows:

Year	Area Irrigated	Water Pumped		Surface Storage 1/	Ground Water
		Avg. Year	Driest Year		
	Acres	Acre Feet			
1980	215,000	114,100	161,700	89,700	72,000
2000	874,000	393,900	585,600	325,600	260,000
2020	1,419,600	765,100	1,114,800	609,800	505,000

SOURCE: USDA data

Irrigation needs will vary considerably from location to location with the Wabash Subarea having the greatest and the Guyandotte-Big Sandy-

1/ Does not include storage losses to seepage and evaporation.

Present Average Annual Damage Showing Possible Solution by Upstream Developments

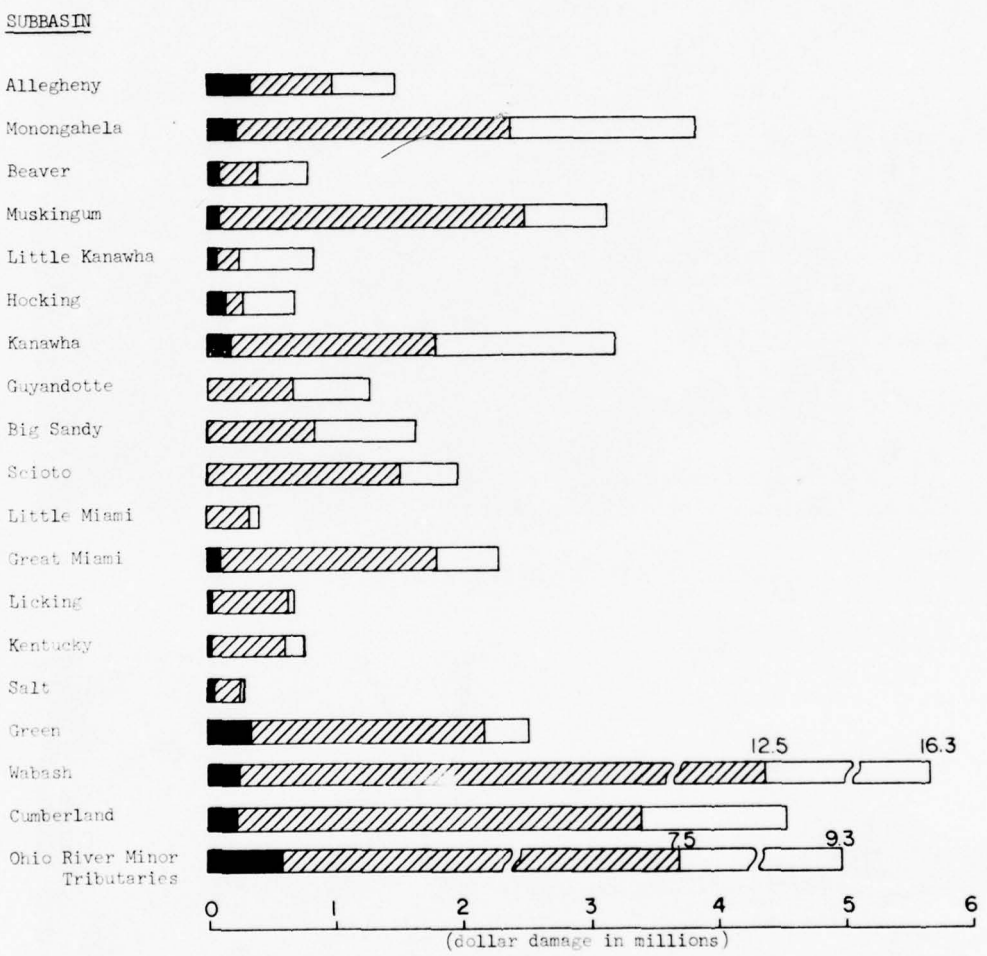
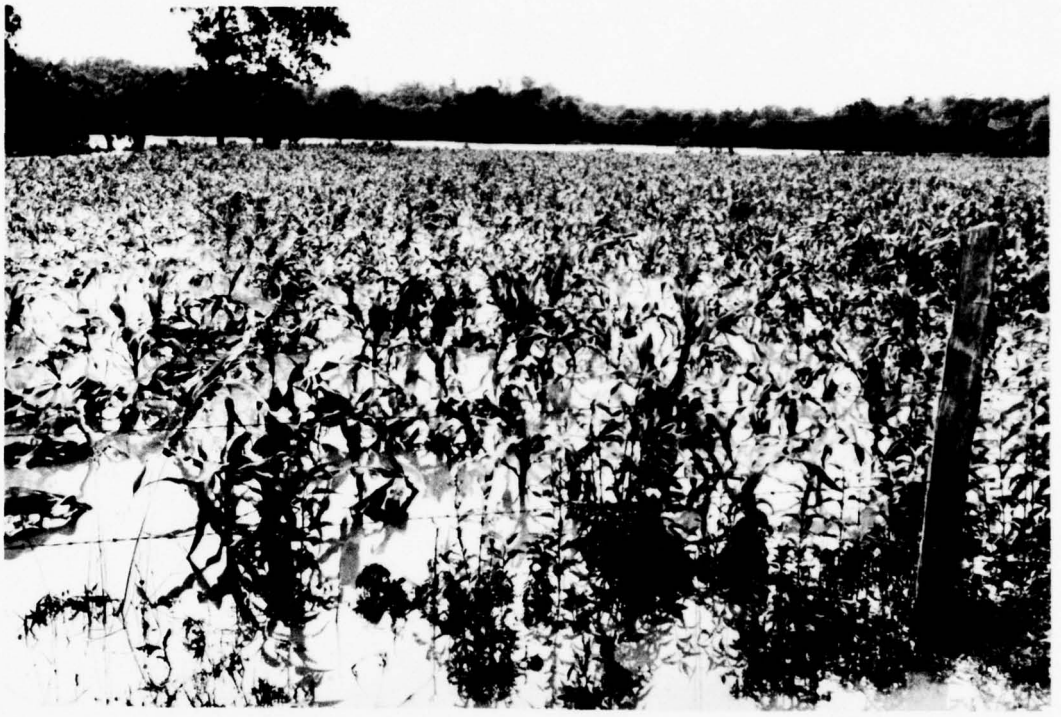


Figure 8

Damage reduction by authorized projects

Damage in potentially feasible projects

Damages in upstream watersheds that do not appear to have project potential



Flood damage to growing crop.

Rural-fringe flood damage.

Little Sandy having the least. Present and projected cropping patterns to meet the demand for food and fiber along with historical drought occurrences were the deciding factors in the determination of these needs. Tables 22 and 23 show the distribution of the areas to be irrigated and the irrigation water needs by subareas.

Agricultural Drainage: There are approximately 6 million acres of farm land in the Basin which need some degree of drainage improvement. Many of these acres will continue to be drained by local owners as flood prevention and major outlets are provided. This development is usually regulated by the need for increased production and efficiency of farm operations. Expected growth in the demand for food and fiber will materially influence the economic feasibility of drainage. The overall economic potential for agricultural land drainage will be 15.3 million acres by 1980, 16.2 million acres by 2000 and 16.6 million acres by 2020 (Table 24). These estimates include the 11 million acres now considered adequately drained.

The elimination of prolonged flooding is often a prerequisite to successful drainage. In some areas multiple purpose channels are designed for both drainage and flood control. The lack of outlets of sufficient depth and capacity is a problem closely related to flood prevention. Adequate floodwater channels would ordinarily fulfill the requirements for drain outlets. Navigation channels, locks and other impoundments along the main stem and major tributaries of river systems tend to raise water levels to heights that impair drainage outlets. This problem is usually considered and adjusted during detailed project evaluations.

Recreation: Basin comprenensive studies show remaining unsatisfied recreation needs to be 105.4 million at the present time (1960 base). The projected needs are to be 332.3 million by 1980; 651.9 million by 2000; and 971.3 million by 2020. Recreation needs and problems are covered in Appendix H, Prospective Outdoor Recreation Demands and Needs Study of the Ohio River Basin. Needs and problems are developed and shown on a subarea basis. It is recognized that considerable opportunities exist for meeting a portion of these needs in upstream areas.

Fish and Wildlife: Fish and wildife needs and problems are covered in detail in Appendix G, Fish and Wildlife Resources of the Ohio River Basin. Basin-wide unsatisfied fishing needs in terms of estimated man days of fishing will be 3.1 million by 1980 and 11.8 million by 2010. Additional hunting needs in terms of estimated man days of hunting will be 3.4 million by 1980 and 5.7 million by 2010. These needs were developed by hydrologic subbasins and portions thereof in the several States or Commonwealths. No attempt was made to identify them with either downstream or upstream areas.

Water Supply

Rural Community - Domestic and Livestock: Water needs for the rural community - domestic and livestock - are expected to fluctuate. Requirements for farm domestic (household) uses will decrease slightly for the entire Basin, although needs in some subareas will rise because of growing per capita water use. The Basin-wide needs will be 39.1 mgd in 1980; 37.4 mgd in 2000; and 35.6 mgd in 2020. Water needs for rural nonfarm uses are expected to rise as both population and per capita use continue to grow. Nonfarm domestic needs will be 673.2 mgd in 1980; 793.9 mgd in 2000; and 934.4 mgd in 2020. Increased water supplies for livestock will be required throughout the Basin, because of rising production and changes in production technology. Livestock requirements will be 129.2 mgd in 1980; 193.9 mgd by 2000; and 258.2 mgd by 2020. Tables 25 and 26 include water needs for the rural community by subareas.

Municipal and Industrial: Water supply studies indicate early needs for both ground water and surface water developments throughout the Basin. It is expected that more than 150 problem areas either exist or will develop by 1980. Without further development these problem areas will increase many fold by 2000 and 2020. In addition to locations studied by the Federal Water Pollution Control Administration, U.S.D.A. study inventories revealed about 400 small towns and rural communities now have or soon will experience significant water supply problems.

Water Quality Control: More than 200 communities of the Basin are expected to have organic quality control problems by 1980. These areas will increase considerably by 2000 and 2020 unless further development and treatment takes place.

Of the eight major categories of water pollutants 1/, five could originate in part on agricultural land and contribute to pollution in the Ohio River Basin. These categories are: sediment, plant nutrients, waste with high oxygen demands, infectious agents and exotic organic chemicals.

Sediment pollution creates problems for recreation, fish and wildlife, and municipal and industrial water supply development. It not only impairs full use of these purposes, but requires expensive corrective treatment. Critical silt source areas could significantly affect both local and Basin-wide developments.

Plant nutrients, particularly phosphorus and nitrogen, are used extensively on agricultural lands in the Ohio River Basin. These nutrient elements, are also present in effluents from secondary sewage treatment plants. Nitrogen generally moves in solutions, but the phosphates are largely absorbed on clay particles that may be transported as sediment. On the average, 1,000 tons of top soil contains 1,000 pounds

1/ Monthly Print No. 9, Senate Select Committee on Water Resources.

of phosphorus. Land practices that control erosion reduces phosphorus pollution to rivers.

Waste with high oxygen demand could arise from plant residue and animal manures that are carried by flood water from farms to the river. Livestock wastes do not receive treatment as do human wastes. One animal unit is considered equal in waste production to 16 humans.

Field observations have indicated that a fecal coliform/fecal streptococcus ratio of less than one, indicates pollution is from animal origin. Infectious agents may be associated with fecal effluents thus, farm livestock could contribute to pollution from this source.

Exotic organic chemicals, such as insecticides and herbicides now widely used on farms in the protection of crops and livestock, have frequently been held responsible for fish and wildlife kills in streams and lakes where traces of these chemicals have been detected. Much needs to be learned about the movement of these chemicals from the point of application to the streams. The Ohio River does receive drainage from large areas of highly commercialized agriculture.

Forest Based Industries: At the present time there are 9 pulp and paper manufacturing plants in the Ohio River Basin. These are usually heavy users of water and are located in the following subareas: Allegheny 1, Ohio-Cincinnati 1, Scioto 2, Little Miami-Great Miami 1, Muskingum 1, White 1, and Wabash 2. All of the above have paper mills integrated in their operations. Total capacity of these mills is 1,185 tons of pulp per 24-hour day. Actual production is estimated at 88% of capacity or approximately 1,040 tons of pulp per day. Also, there are many secondary industries using processed wood pulp or purchased paper in the manufacture of their products.

The fiber, filler, and chemicals in pulp mill effluent cause water pollution if not recovered and are allowed to enter the stream. While usually not harmful to human health, they are harmful to aquatic life and can cause obnoxious odor, color, and unsightly conditions. The degree of this pollution is again based on the pulping process used, whether bleaching is done, and if paper manufacture is integrated in the mill. Many of the pulp and paper mills are contributing to stream pollution. Secondary industries also contribute to water pollution; the amount varying with product manufactured and efficiency of the plants.

In attempting to arrive at the water requirements and adequate pollution control of the pulp and paper industry, it is impossible to assess each mill, to project where mills will be located, or the process they would employ. For preliminary estimates the Federal Water Pollution Control Administration suggests that a flowage rate of 1 cfs of water per ton of daily pulp production be used. This would include water supply and adequate pollution control. These figures are sometimes used for preliminary site evaluations. Actual water requirements should be based on detailed study.

Based on this preliminary estimate figure a mill producing 250 tons of pulp daily would require 162 million gallons of water per day and nearly 59 billion gallons per year. Water required to process the Basin's pulpwood production would amount to approximately 685 billion gallons in 1980; 1,520 billion gallons in 2000; and 2,400 billion gallons in 2020.

Tentative Solutions

Solutions to flood prevention, drainage, irrigation and land treatment needs through additional resource development are expected to be governed by their effects on individual farmer investments, rural community economies and downstream improvements until around 2000. Region and nation-wide demands for food and fiber will determine the rate of these resource developments after about 2000. Developments for services such as, recreation, fish and wildlife, and water supply are expected to respond to the pressures brought on by population growth and economic development.

The accomplishments of existing programs of the U. S. Department of Agriculture are considered in finding solutions to water and related land resource problems and needs. It is the intent of this section to appraise in a general way the opportunities for development which might contribute to the satisfaction of the various needs and problems and to point to the necessity for further and more detailed study.

The production of food and fiber in the Basin requires proper management and treatment of all the lands. Conservation treatment on cropland, pasture and forest with practices to limit the soil loss and utilize moisture are expected to be accomplished on more than 50 million acres by 2020. The application of these practices by farmers and other landowners will cost approximately $1\frac{1}{4}$ billion.

When land shortages develop, internal shifts in major land use are possible which might make more land available for crop production or other essential uses. For example, consideration could be given to a shift of forest lands in Capability Classes 1/ I-IV into cropland. This would provide 9 million acres of new cropland if needed. At the same time, 3 million acres of cropland in Classes V-VIII could be converted into woodland. In this case, a net gain of 6 million acres of cropland could result from this type of land use change. However, the impacts of such major land use changes on resource development could be significant and require more detailed study.

The study identified about 600 potentially feasible watershed projects in the upstream areas. See Plate 5 and Table 32. The Wabash Subbasin has the largest number (198), while the Little Kanawha has the smallest number (2). These potentially feasible projects could reduce existing upstream flood damages by $30.7 million annually, leaving a residual of $22.3 million in non-project area. For a subbasin

1/ The land capability classification is an interpretive grouping of soils made primarily for agricultural purposes.

breakdown, see Figure 8. Also, the opportunity to realize $14.8 million annually through more intensified and changed land use would be possible on the protected flood plains. These projects with flood prevention cost of about $778 million would contain 3.5 million acre feet of floodwater storage, 472,600 acre feet of sediment storage and 6,328 miles of channel improvements. They would protect 1.9 million acres of flood plain land. In addition to flood prevention, the watershed projects have storage and surface area capabilities which would help meet many of the Basin's other water needs.

Multipurpose reservoir - flood prevention and municipal water supply.

Close cooperation and action by industry, farmer and other private owner, as well as public agencies can very materially aid in the solution of the problem of satisfying demands for goods and services from forest land including quality water and wood. An enlightened and interested group of up to 700,000 small forest landowners is the only solution to better forest resource conditions in this Basin.

Increased participation by individual forest landowners in such industry programs as "American Tree Farm System," "Busy Acres," "Keep Green" Campaigns, and "Tree Farm Families" is essential.

Strengthened State forestry organizations for providing additional technical assistance to private owners are essential to solving forest problems in the Basin. The Cooperative Forest Management Act of 1950 and the Watershed Protection and Flood Prevention Act of 1954 (P.L. 566)

enable the Forest Service and State Foresters to provide technical service to small tract owners. Forestry practices of the Agricultural Conservation Program provide financial assistance to these small forest landowners. Also heavily involved are State Extension Foresters, Soil Conservation Service, Soil Conservation District supervisors and county agents.

Increased public agency participation in solving resource problems is also essential. A direct partial solution is illustrated by Tables 27 and 43.

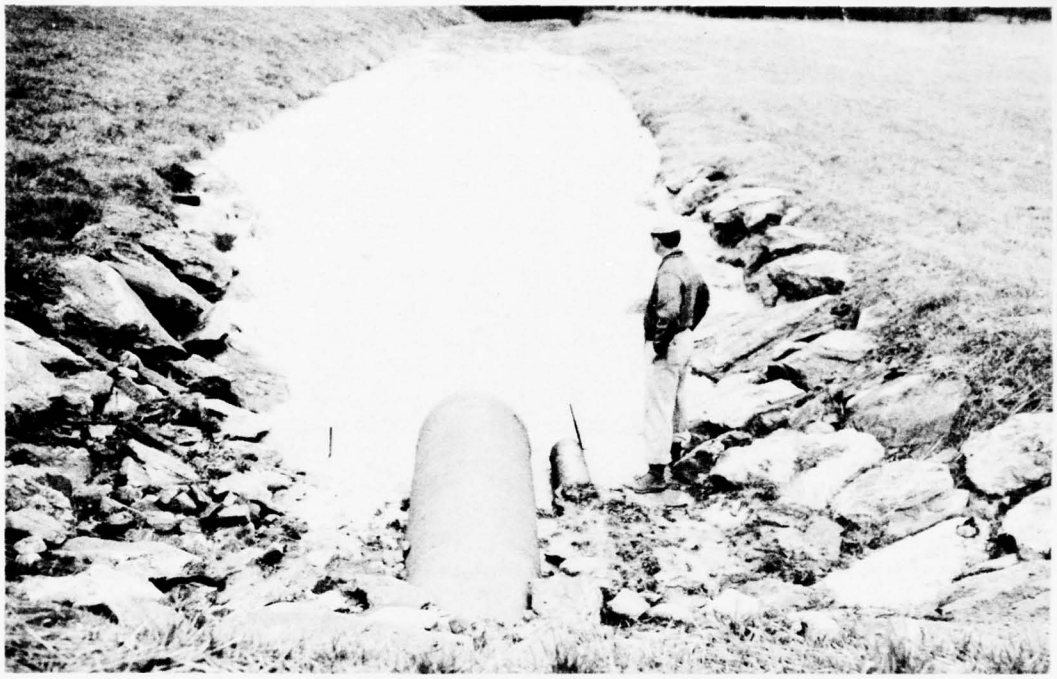
Probable Development

Trends in watershed project development over the past decade, with special consideration given to progress in the latter years, form the basis on which the probable development of potentially feasible projects was projected. Another significant consideration was resource development needs and the apparent urgency of their solution.

Considering probable extent and timing of the development of these potential watersheds, it is estimated that 38 percent would be implemented by 1980, another 48 percent by 2000, and the remaining 14 percent by 2020. Such a development program would offer significant opportunities toward meeting the needs and problems for upstream flood prevention; irrigation; agricultural drainage; recreation; fish and wildlife; and water supply for municipal and industrial and rural community uses; and water quality control. The allocation of these developments to specific purpose or use is beyond the scope of this study. However, the following general appraisal of the watershed capabilities show the potential for meeting problems and needs through upstream projects.

The development of 230 (38 percent) projects by 1980 could reduce $15.3 million in average annual flood damages through the storage of 1.34 million acre feet of floodwater, 182,000 acre feet of sediment and construction of 2,405 miles of channels at a cost of about $306 million. Protection will be provided on 713,000 acres of flood plain lands. In addition to flood damage reduction, these projects would offer the opportunity to develop 88,800 acres of water surface and 133,300 acres of land area for outdoor recreation and fish and wildlife at a cost of $154 million. These water and land areas would be capable of meeting either in combination or separately 44 million recreation, fishing or hunting days. Another development potential, which would be in addition to flood prevention, is the opportunity to store 600,000 acre feet of water supply at a cost of about $75.0 million. The cost of additional storage is based on multiple purpose developments in conjunction with flood prevention. Municipal and industrial, recreation, water quality and other water user interests are expected to share in this additional storage. In some cases two or more interests might compatibly use the same water sources, i.e., recreation and supplemental water supply.

The additional probable developments by 2000 would reduce upstream



Controlled release of floodwater.

flood damages by 25.3 million dollars annually on 900,700 acres of flood plain land, store 227,000 acre feet of sediment, and store 1.67 million acre feet of floodwater at a cost of approximately $374 million. They would include 3,037 miles of channel improvements. In addition to flood protection, they would contain 114,000 acres of water and 171,000 acres of land which could satisfy 57 million recreation, hunting or fishing days or a combination thereof, costing about $196 million. As in the previous development period, water supply potential would be 238,700 acre feet at a cost of around $30.0 million.

It might be reasonable to expect that all potentially feasible watershed projects would be developed by the year 2020. If such is the case, the last projection period developments would further reduce average annual flood damages by $8.5 million on 262,700 acres. The storage of 63,100 acre feet of sediment and 483,000 acre feet of floodwater and the improvement of 886 miles of channels would cost about $98 million. Recreation and/or hunting and fishing opportunities would be realized on 34,700 acres of water and 52,000 acres of land with a capacity to satisfy 17.3 million recreation days at a cost of about $54.4 million. Water supply storage would amount to 160,000 acre feet at a cost of $20.0 million.

In appraising upstream watershed potential throughout the Basin all areas were considered. Resource development potential was estimated for watersheds that did not appear to have project potential. Storage and water surface area capabilities in these areas are substantial and

could play an important part in the Basin's development. The first consideration in appraising this potential was flood prevention. However, there are many opportunities for satisfying other purposes. There are approximately 3,300 potential structure sites capable of storing 12.9 million acre feet with surface areas averaging 115 acres per site (Table 33). Development costs were not estimated but would be somewhat greater than for multiple purpose storage in conjunction with flood prevention.

Unsatisfied needs for flood control cannot be fully met by economically feasible watershed projects. Land treatment and structural measures installed by individuals, local and state agencies may be found feasible in controlling localized flooding or on-site erosion problems. Acceleration of existing programs with more emphasis on multiple purpose developments under P.L. 566 would facilitate the development of potential projects and help justify a number of projects, that do not show potential at this time. Further study would have to be done in these areas to determine scope and feasibility. The Resource Conservation and Development Projects that are authorized in some parts of the Basin will facilitate getting these studies underway.

Cropland treatment and management plays an important role in watershed protection.

Accelerated land treatment under the Soil and Water Conservation District Program will make a significant contribution toward meeting the land treatment needs of the Basin. The cropland treatment will involve using a cropping system along with structural and management measures to improve watershed hydrologic conditions. Likewise, forest and pasture land will involve proper management, protection, and land use practices.

Land treatment measures applied under intensified programs, such as P.L. 566 upstream watershed projects, are estimated to reduce sediment yields from the treated area by 10 percent to 30 percent. Floodwater retarding reservoirs in these upstream watersheds are designed to provide full effectiveness for a minimum period of 50 years. Additional capacity is provided to offset the depletions due to the accumulation of sediment within the reservoir. These structural measures, in conjunction with land treatment measures, offer an effective means of reducing the sediment yield from the area controlled and thereby reducing the sediment damages within the watershed. It is estimated that, the combination of land treatment and an adequate system of floodwater retarding structures, will, reduce sediment damages in watersheds by 50 to 75 percent. Specific studies reveal the tremendous effect this combination has in reducing sediment yields. For example, land treatment practices and floodwater retarding structures in the Salem Fork Basin, West Virginia reduced the annual sediment load from approximately 0.184 acre feet 1/ per square mile in 1956 to only 0.018 acre feet 1/ per square mile in 1960 2/.

Farm ponds play a significant role in watershed management. In addition to their primary functions of livestock water supply, recreation, fish and wildlife, and fire protection, farm ponds have beneficial effects on downstream areas through the reduction of sediment and storm runoff. It is estimated that an additional 83,000 ponds with surface areas of 47,000 acres and storing 180,000 acre feet of water will be built by 1980. Another 75,000 ponds with 39,000 acres of surface and storing 160,000 acre feet of water are expected to be completed by 2000. By 2020 still another 48,000 ponds are estimated to be built with 105,000 acre feet of storage and 26,000 acres of water surface.

Concerted effort from all interests must be directed toward improvement of the quality of available water if all needs by the years 2000 and 2020 are to be met. Much of this effort is needed on farmer owned and miscellaneous private forest lands, since they occupy many of the important watersheds.

To accomplish proper management of forest lands, an accelerated program of watershed management, rehabilitation, and protection should

1/. Assuming a density of 60 lbs. per cubic foot.

2/. Schneider, W. J., et al, 1965, Water Resources of the Appalachian Region - Pennsylvania to Alabama - U. S. Geological Survey Hydrologic Atlas HA-198.

be carried out. This includes measures to stabilize gullies and channels, control sheet erosion, and erosion on roads and trails. Also included are measures to restore vegetative cover to strip mine spoil banks to halt erosion, stream silting, and acid water pollution. These measures should be aimed at preventing accelerated erosion and water pollution at its source as a more effective and less costly method than attempting to cure it after it has occurred.

Forest land watersheds in good hydrologic condition are a necessary supplement to the structural water supply and flood control facilities. Forest cover in good condition will retard the runoff from storms, prevent soil erosion, and improve water quality. Good forested watersheds help to increase percolation of rainfall which prolongs periods of stream flow and adds to the supply of water to underground aquifers. Watershed improvement is accomplished through various land treatment measures including tree, grass and shrub planting; contour trenching; timber stand improvement; improved harvesting practices; and livestock and wildlife grazing control. A future goal should be to put many more acres of privately owned forest land under proper watershed management. Fire protection and control along with insect and disease control should be of major concern and increased where necessary.

On the alert - protecting the watershed from fire.

Sufficient data to define specific problems, evaluate impacts and determine probable solutions to water pollution from agricultural activities are not available from the framework study. In order to obtain the information needed for a complete evaluation of these sources of pollution, further study on a project basis will be required.

Water and related land resource needs are Basin-wide. These have been tabulated by both economic subareas and hydrologic subbasins as previously discussed. Tentative solutions have been determined by hydrologic subbasins in keeping with current resource development programs. Those needs and problems which were developed by subareas have been prorated into subareas for the sake of arriving at possible solutions, i.e., drainage, irrigation, and recreation. In some cases, subbasin development quantities exceed similarly named subarea needs since the subbasin encompassed a larger land area than the subarea. Tentative solutions to needs and problems in terms of USDA development programs by subbasins follow:

USDA RESOURCE DEVELOPMENT PROGRAM

Allegheny Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	291.96	344.96	191.20	114.06	146.94	16.00	177.90	198.02	175.20
Pastureland Area	1,000 Ac.	127.69	155.78	91.10	47.85	61.65	6.80	79.84	94.13	84.30
Woodland Area	1,000 Ac.	863.82	1,014.36	545.20	353.64	455.61	49.20	510.18	558.75	496.00
Cost	$1,000,000	32.09	37.88	20.68	12.89	16.61	1.80	19.20	21.27	18.88
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	66.55	75.54	37.77	66.55	75.54	37.77			
Sediment Storage	1,000 Ac. Ft.	5.36	6.09	3.05	5.36	6.09	3.05			
Area Protected	1,000 Ac.	15.48	17.57	8.79	15.48	17.57	8.79			
Cost	$1,000,000	10.42	11.82	5.91	10.42	11.82	5.91			
Recreation and Fish & Wildlife *										
Water Area	1,000 Ac.	12.49	15.37	13.10	3.52	4.00	2.00	8.97	11.37	11.10
Land Area	1,000 Ac.	6.98	8.10	5.10	5.28	6.00	3.00	1.70	2.10	2.10
Recreation Days	1,000,000 Da.	6.13	7.52	6.44	1.76	2.00	1.00	4.37	5.52	5.44
Cost	$1,000,000	18.27	22.52	19.30	5.28	6.00	3.00	12.99	16.52	16.30
Water Supply										
Municipal & Ind.										
Storage	1,000 Ac. Ft.	19.00			19.00					
Cost	$1,000,000	2.38			2.38					
Quality Control										
Storage	1,000 Ac. Ft.	10.70			10.70					
Cost	$1,000,000	1.34			1.34					
Irrigation Water										
Storage	1,000 Ac. Ft.									
Cost	$1,000,000									
Irrigation **										
Land Area	1,000 Ac.	2.10	1.32	1.50						
Cost	$1,000,000	.20	.12	.14						
Drainage **										
Land Area	1,000 Ac.	36.84	9.50	.38						
Cost	$1,000,000	6.04	1.56	.06						

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	7.24	1,000 Acres
	Outside Potential Watersheds	32.08	1,000 Acres
	Total	39.32	1,000 Acres
2. Water Storage:	In Potential Watersheds	152.30	1,000 Ac. Ft.
	Outside Potertial Watersheds	960.15	1,000 Ac. Ft.
	Total	1,112.45	1,000 Ac. Ft.

* Data shown in outside potential watershed projects includes National Forest developments which may or may not be in potential watersheds.

** Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Monongahela Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	122.64	133.37	74.81	50.25	50.25		72.39	83.12	74.81
Pastureland Area	1,000 Ac.	192.04	204.98	107.87	85.12	85.12		106.92	119.86	107.87
Woodland Area	1,000 Ac.	536.50	571.56	298.75	239.62	239.62		296.88	331.94	298.75
Cost	$1,000,000	21.27	22.74	12.04	9.37	9.37		11.90	13.37	12.04
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	55.64	55.64		55.64	55.64				
Sediment Storage	1,000 Ac. Ft.	6.50	6.50		6.50	6.50				
Area Protected	1,000 Ac.	7.53	7.53		7.53	7.53				
Cost	$1,000,000	19.80	19.70		19.80	19.70				
Recreation and Fish & Wildlife *										
Water Area	1,000 Ac.	4.54	5.86	4.82	1.82	1.82		2.72	4.04	4.82
Land Area	1,000 Ac.	3.39	3.75	1.08	2.87	2.87		.52	.88	1.08
Recreation Days	1,000,000 Da.	2.16	2.84	2.35	.91	.91		1.25	1.93	2.35
Cost	$1,000,000	8.12	10.14	7.02	4.40	4.40		3.72	5.74	7.02
Water Supply										
Municipal & Ind.										
Storage	1,000 Ac. Ft.	5.50			5.50					
Cost	$1,000,000	.69			.69					
Quality Control										
Storage	1,000 Ac. Ft.	9.52			9.52					
Cost	$1,000,000	1.19			1.19					
Irrigation Water										
Storage	1,000 Ac. Ft.									
Cost	$1,000,000									
Irrigation **										
Land Area	1,000 Ac.	1.10	.72	.70						
Cost	$1,000,000	.11	.07	.06						
Drainage **										
Land Area	1,000 Ac.	45.17	3.76							
Cost	$1,000,000	6.64	.55							

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	6.35	1,000 Acres
	Outside Potential Watersheds	18.65	1,000 Acres
	Total	25.00	1,000 Acres
2. Water Storage:	In Potential Watersheds	83.48	1,000 Ac. Ft.
	Outside Potential Watersheds	417.03	1,000 Ac. Ft.
	Total	500.51	1,000 Ac. Ft.

* Data shown in outside potential watershed projects includes National Forest developments which may or may not be in potential watersheds.

** Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Beaver Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	144.76	129.56	71.51	75.15	50.10		69.61	79.46	71.51
Pastureland Area	1,000 Ac.	47.86	43.29	24.38	24.30	16.20		23.56	27.09	24.38
Woodland Area	1,000 Ac.	113.95	103.29	58.40	57.60	38.40		56.35	64.89	58.40
Cost	$1,000,000	7.67	6.91	3.86	3.93	2.62		3.74	4.29	3.86
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	26.06	17.37		26.06	17.37				
Sediment Storage	1,000 Ac. Ft.	2.55	1.70		2.55	1.70				
Area Protected	1,000 Ac.	5.14	3.42		5.14	3.42				
Cost	$1,000,000	4.90	3.30		4.90	3.30				
Recreation and Fish & Wildlife										
Water Area	1,000 Ac.	1.39	.97	.09	1.24	.83		.15	.14	.09
Land Area	1,000 Ac.	1.86	1.25		1.86	1.25				
Recreation Days	1,000,000 Da.	.66	.46	.02	.62	.42		.04	.04	.02
Cost	$1,000,000	2.32	1.51	.07	2.20	1.40		.12	.11	.07
Water Supply										
Municipal & Ind.										
Storage	1,000 Ac. Ft.	4.00			4.00					
Cost	$1,000,000	.50			.50					
Quality Control										
Storage	1,000 Ac. Ft.									
Cost	$1,000,000									
Irrigation Water										
Storage	1,000 Ac. Ft.									
Cost	$1,000,000									
Irrigation *										
Land Area	1,000 Ac.	.56	.59	1.18						
Cost	$1,000,000	.05	.06	1.09						
Drainage *										
Land Area	1,000 Ac.	98.60	19.20	7.52						
Cost	$1,000,000	17.55	3.42	1.34						

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	2.36	1,000 Acres
	Outside Potential Watersheds	8.94	1,000 Acres
	Total	11.30	1,000 Acres
2. Water Storage:	In Potential Watersheds	10.60	1,000 Ac. Ft.
	Outside Potential Watersheds	140.88	1,000 Ac. Ft.
	Total	151.48	1,000 Ac. Ft.

* Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Muskingum Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	408.43	405.52	226.50	231.75	231.75	92.25	176.68	173.77	134.25
Pastureland Area	1,000 Ac.	251.26	249.26	138.93	142.93	142.93	56.89	108.33	106.33	82.04
Woodland Area	1,000 Ac.	265.58	264.23	148.31	149.80	149.80	59.64	115.78	114.43	88.67
Cost	$1,000,000	23.13	22.97	12.84	13.11	13.11	5.22	10.02	9.86	7.62
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	65.30	65.30	25.99	65.30	65.30	25.99			
Sediment Storage	1,000 Ac. Ft.	12.26	12.26	4.88	12.26	12.26	4.88			
Area Protected	1,000 Ac.	49.45	49.45	19.69	49.45	49.45	19.69			
Cost	$1,000,000	23.40	23.40	9.40	23.40	23.40	9.40			
Recreation and Fish & Wildlife *										
Water Area	1,000 Ac.	6.39	7.26	4.33	4.88	4.88	1.94	1.51	2.38	2.39
Land Area	1,000 Ac.	7.57	7.63	3.27	7.32	7.32	2.90	.25	.31	.37
Recreation Days	1,000,000 Da.	2.99	3.45	2.05	2.44	2.44	.97	.55	1.01	1.08
Cost	$1,000,000	10.11	11.62	6.69	8.40	8.40	3.20	1.71	3.22	3.49
Water Supply										
Municipal & Ind.										
Storage	1,000 Ac. Ft.	73.50	7.75		73.50	7.75				
Cost	$1,000,000	9.19	.97		9.19	.97				
Quality Control										
Storage	1,000 Ac. Ft.	45.00	4.52		45.00	4.52				
Cost	$1,000,000	5.63	.57		5.63	.57				
Irrigation Water										
Storage	1,000 Ac. Ft.	1.43	6.22	4.80	.95	4.15	3.20	.48	2.07	1.60
Cost	$1,000,000	.19	.83	.64	.12	.52	.40	.07	.31	.24
Irrigation **										
Land Area	1,000 Ac.	3.40	16.60	12.80						
Cost	$1,000,000	.32	1.52	1.18						
Drainage **										
Land Area	1,000 Ac.	168.84	27.20	10.83						
Cost	$1,000,000	26.17	4.22	1.68						

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	28.79	1,000 Acres
	Outside Potential Watersheds	31.34	1,000 Acres
	Total	60.13	1,000 Acres
2. Water Storage:	In Potential Watersheds	625.93	1,000 Ac. Ft.
	Outside Potential Watersheds	1,042.74	1,000 Ac. Ft.
	Total	1,668.67	1,000 Ac. Ft.

* Data shown in outside potential watershed projects includes National Forest developments which may or may not be in potential watersheds.

** Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Little Kanawha Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	19.17	21.56	19.40	3.00			16.17	21.56	19.40
Pastureland Area	1,000 Ac.	40.70	46.26	41.64	6.00			34.70	46.26	41.64
Woodland Area	1,000 Ac.	151.64	173.18	155.86	21.75			129.89	173.18	155.86
Cost	$1,000,000	5.29	6.02	5.42	.77			4.52	6.02	5.42
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	7.39			7.39					
Sediment Storage	1,000 Ac. Ft.	1.10			1.10					
Area Protected	1,000 Ac.	.98			.98					
Cost	$1,000,000	2.10			2.10					
Recreation and Fish & Wildlife										
Water Area	1,000 Ac.	.43	.23	.15	.17			.26	.23	.15
Land Area	1,000 Ac.	.25			.25					
Recreation Days	1,000,000 Da.	.18	.08	.05	.09			.09	.08	.05
Cost	$1,000,000	.86	.23	.15	.60			.26	.23	.15
Water Supply										
Municipal & Ind.										
Storage	1,000 Ac. Ft.	1.25			1.25					
Cost	$1,000,000	.16			.16					
Quality Control										
Storage	1,000 Ac. Ft.									
Cost	$1,000,000									
Irrigation Water										
Storage	1,000 Ac. Ft.									
Cost	$1,000,000									
Irrigation *										
Land Area	1,000 Ac.	.13	.27	.29						
Cost	$1,000,000	.01	.02	.03						
Drainage *										
Land Area	1,000 Ac.	1.04								
Cost	$1,000,000	.15								

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	.85	1,000 Acres
	Outside Potential Watersheds	7.04	1,000 Acres
	Total	7.89	1,000 Acres
2. Water Storage:	In Potential Watersheds	9.05	1,000 Ac. Ft.
	Outside Potential Watersheds	232.78	1,000 Ac. Ft.
	Total	241.83	1,000 Ac. Ft.

* Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Hocking Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	62.46	13.28	11.95	52.50			9.96	13.28	11.95
Pastureland Area	1,000 Ac.	25.99	5.65	5.08	21.75			4.24	5.65	5.08
Woodland Area	1,000 Ac.	48.37	10.50	9.45	40.50			7.87	10.50	9.45
Cost	$1,000,000	3.42	.74	.66	2.87			.55	.74	.66
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	10.07			10.07					
Sediment Storage	1,000 Ac. Ft.	2.35			2.35					
Area Protected	1,000 Ac.	8.75			8.75					
Cost	$1,000,000	4.80			4.80					
Recreation and Fish & Wildlife *										
Water Area	1,000 Ac.	5.15	9.44	10.79	.98			4.17	9.44	10.79
Land Area	1,000 Ac.	2.82	1.68	2.01	1.47			1.35	1.68	2.01
Recreation Days	1,000,000 Da.	2.56	4.70	5.38	.49			2.07	4.70	5.38
Cost	$1,000,000	10.44	18.79	21.49	2.20			8.24	18.79	21.49
Water Supply Municipal & Ind.										
Storage	1,000 Ac. Ft.	14.50			14.50					
Cost	$1,000,000	1.81			1.81					
Quality Control										
Storage	1,000 Ac. Ft.									
Cost	$1,000,000									
Irrigation Water										
Storage	1,000 Ac. Ft.	.29	.94	.53	.12			.17	.94	.53
Cost	$1,000,000	.05	.14	.08	.02			.03	.14	.08
Irrigation **										
Land Area	1,000 Ac.	1.04	4.71	2.64						
Cost	$1,000,000	.10	.43	.24						
Drainage **										
Land Area	1,000 Ac.	16.08								
Cost	$1,000,000	2.25								

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	1.24	1,000 Acres
	Outside Potential Watersheds	5.98	1,000 Acres
	Total	7.22	1,000 Acres
2. Water Storage:	In Potential Watersheds	16.88	1,000 Ac. Ft.
	Outside Potential Watersheds	227.88	1,000 Ac. Ft.
	Total	244.76	1,000 Ac. Ft.

* Data shown in outside potential watershed projects includes National Forest developments which may or may not be in potential watersheds.

** Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Kanawha Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	122.20	137.51	85.63	42.37	42.37		79.83	95.14	85.63
Pastureland Area	1,000 Ac.	260.71	293.84	183.80	89.62	89.62		171.09	204.22	183.80
Woodland Area	1,000 Ac.	978.64	1,101.00	685.13	339.75	339.75		638.89	761.25	685.13
Cost	$1,000,000	34.04	38.31	23.86	11.79	11.79		22.25	26.52	23.86
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	110.88	110.88		110.88	110.88				
Sediment Storage	1,000 Ac. Ft.	13.00	13.00		13.00	13.00				
Area Protected	1,000 Ac.	9.54	9.54		9.54	9.54				
Cost	$1,000,000	22.90	22.90		22.90	22.90				
Recreation and Fish & Wildlife *										
Water Area	1,000 Ac.	8.94	12.15	10.75	3.35	3.35		5.59	8.80	10.75
Land Area	1,000 Ac.	10.95	16.80	20.87	5.03	5.03		5.92	11.77	20.87
Recreation Days	1,000,000 Da.	4.27	5.90	5.26	1.68	1.68		2.59	4.22	5.26
Cost	$1,000,000	17.61	24.18	20.71	7.80	7.80		9.81	16.38	20.71
Water Supply										
Municipal & Ind.										
Storage	1,000 Ac. Ft.	14.00			14.00					
Cost	$1,000,000	1.75			1.75					
Quality Control										
Storage	1,000 Ac. Ft.	4.54	3.50		4.54	3.50				
Cost	$1,000,000	.58	.44		.58	.44				
Irrigation Water										
Storage	1,000 Ac. Ft.									
Cost	$1,000,000									
Irrigation **										
Land Area	1,000 Ac.	.67	1.43	1.51						
Cost	$1,000,000	.06	.13	.14						
Drainage **										
Land Area	1,000 Ac.	33.38	5.25							
Cost	$1,000,000	4.91	.77							

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	4.30	1,000 Acres
	Outside Potential Watersheds	48.38	1,000 Acres
	Total	52.68	1,000 Acres
2. Water Storage:	In Potential Watersheds	70.56	1,000 Ac. Ft.
	Outside Potential Watersheds	2,048.43	1,000 Ac. Ft.
	Total	2,118.99	1,000 Ac. Ft.

* Data shown in outside potential watershed projects includes National Forest developments which may or may not be in potential watersheds.

** Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Guyandotte Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	8.58	7.74	3.79	4.72	3.53		3.86	4.21	3.79
Pastureland Area	1,000 Ac.	12.90	11.49	5.43	7.29	5.46		5.61	6.03	5.43
Woodland Area	1,000 Ac.	181.41	162.12	77.43	101.67	76.08		79.74	86.04	77.43
Cost	$1,000,000	5.07	4.54	2.17	2.84	2.13		2.23	2.41	2.17
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	20.37	15.24		20.37	15.24				
Sediment Storage	1,000 Ac. Ft.	2.89	2.17		2.89	2.17				
Area Protected	1,000 Ac.	4.07	3.05		4.07	3.05				
Cost	$1,000,000	8.20	6.20		8.20	6.20				
Recreation and Fish & Wildlife										
Water Area	1,000 Ac.	1.08	.81	.04	1.01	.75		.07	.06	.04
Land Area	1,000 Ac.	1.52	1.13		1.52	1.13				
Recreation Days	1,000,000 Da.	.52	.40	.01	.50	.38		.02	.02	.01
Cost	$1,000,000	2.27	1.66	.04	2.20	1.60		.07	.06	.04
Water Supply										
Municipal & Ind.										
Storage	1,000 Ac. Ft.	1.65			1.65					
Cost	$1,000,000	.21			.21					
Quality Control										
Storage	1,000 Ac. Ft.									
Cost	$1,000,000									
Irrigation Water										
Storage	1,000 Ac. Ft.									
Cost	$1,000,000									
Irrigation *										
Land Area	1,000 Ac.	.05	.07	.12						
Cost	$1,000,000	.005	.007	.01						
Drainage *										
Land Area	1,000 Ac.	3.00	.50	.75						
Cost	$1,000,000	.49	.08	.12						

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	.50	1,000 Acres
	Outside Potential Watersheds	3.17	1,000 Acres
	Total	3.67	1,000 Acres
2. Water Storage:	In Potential Watersheds	12.95	1,000 Ac. Ft.
	Outside Potential Watersheds	145.77	1,000 Ac. Ft.
	Total	158.72	1,000 Ac. Ft.

* Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Big Sandy Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	19.79	24.15	8.78	9.60	14.40		10.19	9.75	8.78
Pastureland Area	1,000 Ac.	29.34	35.76	12.74	14.40	21.60		14.94	14.16	12.74
Woodland Area	1,000 Ac.	410.84	501.52	183.66	198.30	297.45		212.54	204.07	183.66
Cost	$1,000,000	11.50	14.04	5.13	5.56	8.34		5.94	5.70	5.13
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	44.28	66.42		44.28	66.42				
Sediment Storage	1,000 Ac. Ft.	6.00	9.00		6.00	9.00				
Area Protected	1,000 Ac.	8.76	13.14		8.76	13.14				
Cost	$1,000,000	7.20	10.80		7.20	10.80				
Recreation and Fish & Wildlife *										
Water Area	1,000 Ac.	4.11	6.55	2.72	2.98	4.46		1.13	2.09	2.72
Land Area	1,000 Ac.	8.48	14.87	15.05	4.46	6.70		4.02	8.17	15.05
Recreation Days	1,000,000 Da.	2.03	3.25	1.34	1.49	2.23		.54	1.02	1.34
Cost	$1,000,000	7.30	11.64	4.82	5.40	8.00		1.90	3.64	4.82
Water Supply										
Municipal & Ind.										
Storage	1,000 Ac. Ft.	5.00			5.00					
Cost	$1,000,000	.63			.63					
Quality Control										
Storage	1,000 Ac. Ft.									
Cost	$1,000,000									
Irrigation Water										
Storage	1,000 Ac. Ft.									
Cost	$1,000,000									
Irrigation **										
Land Area	1,000 Ac.	.13	.19	.31						
Cost	$1,000,000	.014	.02	.03						
Drainage **										
Land Area	1,000 Ac.	7.56	1.26	1.80						
Cost	$1,000,000	1.22	.20	.31						

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	2.68	1,000 Acres
	Outside Potential Watersheds	3.17	1,000 Acres
	Total	5.85	1,000 Acres
2. Water Storage:	In Potential Watersheds	42.75	1,000 Ac. Ft.
	Outside Potential Watersheds	140.39	1,000 Ac. Ft.
	Total	183.14	1,000 Ac. Ft.

* Data shown in outside potential watershed projects includes National Forest developments which may or may not be in potential watersheds.

** Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Scioto Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	577.98	695.53	191.41	321.90	482.85		256.08	212.68	191.41
Pastureland Area	1,000 Ac.	124.78	152.09	54.26	61.20	91.80		63.58	60.29	54.26
Woodland Area	1,000 Ac.	192.82	239.24	112.04	76.50	114.75		116.32	124.49	112.04
Cost	$1,000,000	22.39	27.17	8.94	11.49	17.23		10.90	9.94	8.94
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	24.84	37.25		24.84	37.25				
Sediment Storage	1,000 Ac. Ft.	4.80	7.20		4.80	7.20				
Area Protected	1,000 Ac.	30.55	45.83		30.55	45.83				
Cost	$1,000,000	13.80	20.70		13.80	20.70				
Recreation and Fish & Wildlife *										
Water Area	1,000 Ac.	5.81	8.56	3.91	3.00	4.50		2.81	4.06	3.91
Land Area	1,000 Ac.	4.87	7.20	.55	4.50	6.75		.37	.45	.55
Recreation Days	1,000,000 Da.	2.46	3.88	1.69	1.50	2.25		.96	1.63	1.69
Cost	$1,000,000	8.55	13.82	5.91	5.40	8.20		3.15	5.62	5.91
Water Supply										
Municipal & Ind.										
Storage	1,000 Ac. Ft.	14.50	16.50		14.50	16.50				
Cost	$1,000,000	1.81	2.06		1.81	2.06				
Quality Control										
Storage	1,000 Ac. Ft.	4.61			4.61					
Cost	$1,000,000	.58			.58					
Irrigation Water										
Storage	1,000 Ac. Ft.	7.58	32.14	12.32	4.79	20.45		2.79	11.69	12.32
Cost	$1,000,000	1.02	4.31	1.85	.60	2.56		.42	1.75	1.85
Irrigation **										
Land Area	1,000 Ac.	18.08	88.67	49.28						
Cost	$1,000,000	1.66	8.16	4.53						
Drainage **										
Land Area	1,000 Ac.	380.15	62.33							
Cost	$1,000,000	48.28	7.92							

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	3.11	1,000 Acres
	Outside Potential Watersheds	9.48	1,000 Acres
	Total	12.59	1,000 Acres
2. Water Storage:	In Potential Watersheds	0	1,000 Ac. Ft.
	Outside Potential Watersheds	230.52	1,000 Ac. Ft.
	Total	230.52	1,000 Ac. Ft.

* Data shown in outside potential watershed projects includes National Forest developments which may or may not be in potential watersheds.

** Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

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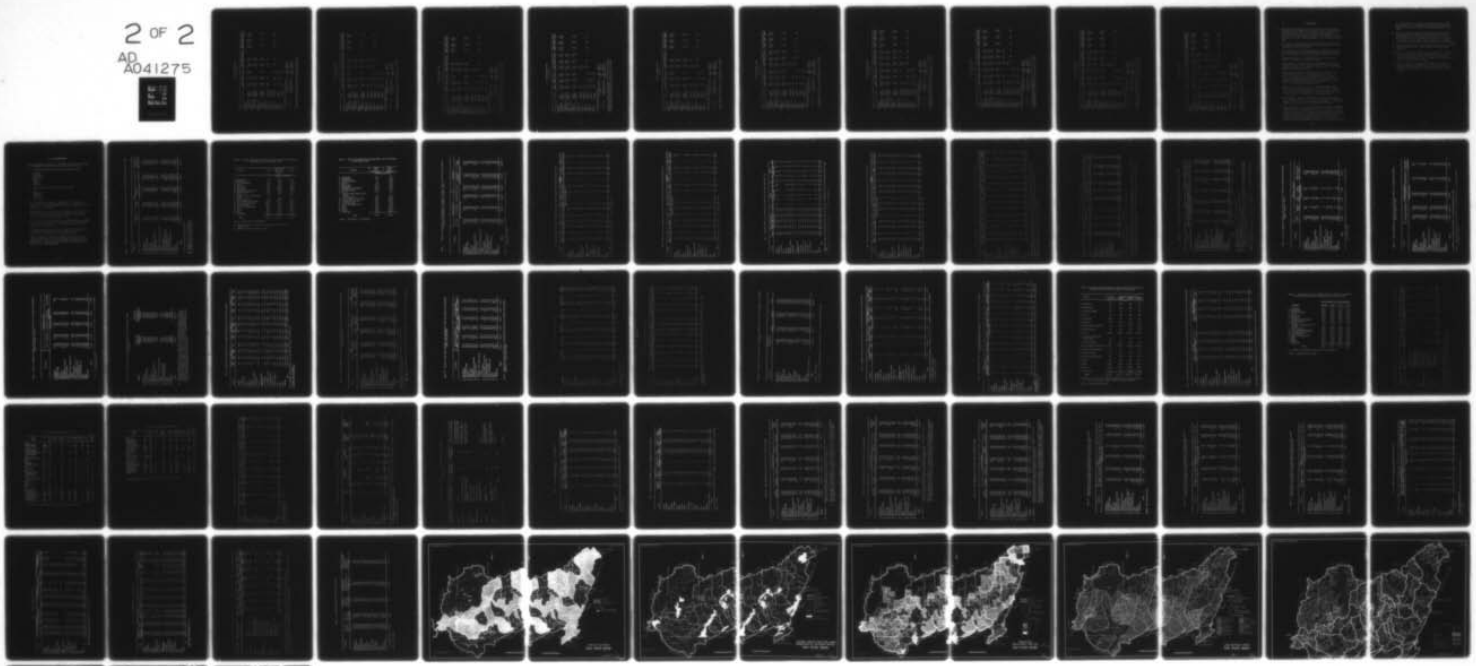

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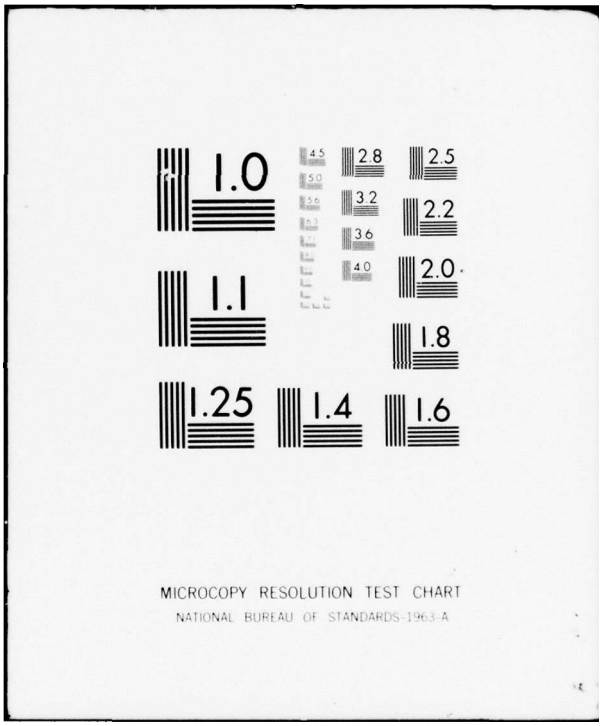
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USDA RESOURCE DEVELOPMENT PROGRAM

Little Miami Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	218.03	144.59	62.25	151.07	75.43		66.96	69.16	62.25
Pastureland Area	1,000 Ac.	47.16	35.79	19.62	28.01	13.99		19.15	21.80	19.63
Woodland Area	1,000 Ac.	42.38	34.25	20.49	23.01	11.49		19.37	22.76	20.49
Cost	$1,000,000	7.69	5.36	2.56	5.05	2.52		2.64	2.84	2.56
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	19.01	9.49		19.01	9.49				
Sediment Storage	1,000 Ac. Ft.	3.34	1.67		3.34	1.67				
Area Protected	1,000 Ac.	12.99	6.49		12.99	6.49				
Cost	$1,000,000	7.20	3.60		7.20	3.60				
Recreation and Fish & Wildlife										
Water Area	1,000 Ac.	2.16	1.36	.42	1.43	.71		.73	.65	.42
Land Area	1,000 Ac.	2.15	1.07		2.15	1.07				
Recreation Days	1,000,000 Da.	.89	.51	.10	.72	.36		.17	.15	.10
Cost	$1,000,000	3.08	1.83	.28	2.60	1.40		.48	.43	.28
Water Supply Municipal & Ind.										
Storage	1,000 Ac. Ft.	15.87	2.00		15.87	2.00				
Cost	$1,000,000	1.98	.25		1.98	.25				
Quality Control										
Storage	1,000 Ac. Ft.									
Cost	$1,000,000									
Irrigation Water										
Storage	1,000 Ac. Ft.	2.57	10.23	5.46	1.68	6.67		.89	3.56	5.46
Cost	$1,000,000	.34	1.36	.82	.21	.83		.13	.53	.82
Irrigation *										
Land Area	1,000 Ac.	6.03	27.57	21.84						
Cost	$1,000,000	.56	2.54	2.01						
Drainage *										
Land Area	1,000 Ac.	127.45	21.68	15.24						
Cost	$1,000,000	17.97	3.05	2.15						

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	2.13	1,000 Acres
	Outside Potential Watersheds	5.58	1,000 Acres
	Total	7.71	1,000 Acres
2. Water Storage:	In Potential Watersheds	0	1,000 Ac. Ft.
	Outside Potential Watersheds	97.83	1,000 Ac. Ft.
	Total	97.83	1,000 Ac. Ft.

* Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Great Miami Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	541.94	621.94	108.86	351.02	500.98		190.92	120.96	108.86
Pastureland Area	1,000 Ac.	101.11	116.21	21.24	64.89	92.61		36.22	23.60	21.24
Woodland Area	1,000 Ac.	85.16	98.04	18.78	54.07	77.17		31.09	20.87	18.78
Cost	$1,000,000	18.21	20.91	3.72	11.75	16.77		6.46	4.14	3.72
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	40.34	57.57		40.34	57.57				
Sediment Storage	1,000 Ac. Ft.	7.50	10.70		7.50	10.70				
Area Protected	1,000 Ac.	31.40	44.81		31.40	44.81				
Cost	$1,000,000	17.09	24.40		17.09	24.40				
Recreation and Fish & Wildlife										
Water Area	1,000 Ac.	5.41	4.19	.73	2.14	3.06		1.27	1.13	.73
Land Area	1,000 Ac.	3.21	4.58		3.21	4.58				
Recreation Days	1,000,000 Da.	1.37	1.79	.17	1.07	1.53		.30	.26	.17
Cost	$1,000,000	5.05	6.95	.49	4.20	6.20		.85	.75	.49
Water Supply Municipal & Ind.										
Storage	1,000 Ac. Ft.	18.80	10.30		18.80	10.30				
Cost	$1,000,000	2.35	1.29		2.35	1.29				
Quality Control										
Storage	1,000 Ac. Ft.	3.62	1.19		3.62	1.19				
Cost	$1,000,000	.45	.15		.45	.15				
Irrigation Water										
Storage	1,000 Ac. Ft.	7.46	32.40	11.43	5.56	24.15		1.90	8.25	11.43
Cost	$1,000,000	.99	4.26	1.71	.70	3.02		.29	1.24	1.71
Irrigation *										
Land Area	1,000 Ac.	16.27	81.31	45.71						
Cost	$1,000,000	1.50	7.48	4.21						
Drainage *										
Land Area	1,000 Ac.	336.39	56.38	26.00						
Cost	$1,000,000	47.43	7.95	3.67						

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	6.63	1,000 Acres
	Outside Potential Watersheds	7.25	1,000 Acres
	Total	13.88	1,000 Acres
2. Water Storage:	In Potential Watersheds	0	1,000 Ac. Ft.
	Outside Potential Watersheds	155.88	1,000 Ac. Ft.
	Total	155.88	1,000 Ac. Ft.

* Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Licking Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	79.95	92.14	46.55	33.07	40.42		46.88	51.72	46.55
Pastureland Area	1,000 Ac.	129.68	148.71	72.96	55.35	67.65		74.33	81.06	72.96
Woodland Area	1,000 Ac.	187.25	215.01	106.27	79.31	96.94		107.94	118.07	106.27
Cost	$1,000,000	9.92	11.40	5.64	4.19	5.13		5.73	6.27	5.64
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	36.94	45.15		36.94	45.15				
Sediment Storage	1,000 Ac. Ft.	5.96	7.29		5.96	7.29				
Area Protected	1,000 Ac.	13.03	15.93		13.03	15.93				
Cost	$1,000,000	5.10	6.40		5.10	6.40				
Recreation and Fish & Wildlife *										
Water Area	1,000 Ac.	3.77	4.09	.91	2.20	2.69		1.57	1.40	.91
Land Area	1,000 Ac.	3.80	4.79	1.00	3.30	4.04		.50	.75	1.00
Recreation Days	1,000,000 Da.	1.83	2.14	.95	1.10	1.34		.73	.80	.95
Cost	$1,000,000	5.53	6.55	2.86	3.40	4.20		2.13	2.35	2.86
Water Supply Municipal & Ind.										
Storage	1,000 Ac. Ft.	9.40			9.40					
Cost	$1,000,000	1.18			1.18					
Quality Control										
Storage	1,000 Ac. Ft.	10.57			10.57					
Cost	$1,000,000	1.32			1.32					
Irrigation Water										
Storage	1,000 Ac. Ft.	3.22	3.71	.42	1.38	1.59		1.84	2.12	.42
Cost	$1,000,000	.45	.52	.06	.17	.20		.28	.32	.06
Irrigation **										
Land Area	1,000 Ac.	6.71	8.98	1.28						
Cost	$1,000,000	.62	.83	.12						
Drainage **										
Land Area	1,000 Ac.	14.36	1.99	.80						
Cost	$1,000,000	2.53	.35	.14						

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	6.85	1,000 Acres
	Outside Potential Watersheds	2.39	1,000 Acres
	Total	9.24	1,000 Acres
2. Water Storage:	In Potential Watersheds	93.53	1,000 Ac. Ft.
	Outside Potential Watersheds	61.52	1,000 Ac. Ft.
	Total	155.05	1,000 Ac. Ft.

* Data shown in outside potential watershed projects includes National Forest developments which may or may not be in potential watersheds.

** Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Kentucky Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	142.30	164.44	107.40	57.88	70.75	30.37	84.42	93.69	77.03
Pastureland Area	1,000 Ac.	233.78	269.61	175.04	96.37	117.81	50.56	137.41	151.80	124.48
Woodland Area	1,000 Ac.	338.20	390.72	254.94	137.86	168.54	72.34	200.34	222.18	182.60
Cost	$1,000,000	17.85	20.62	13.43	7.30	8.93	3.83	10.55	11.69	9.60
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	95.77	117.09	50.25	95.77	117.09	50.25			
Sediment Storage	1,000 Ac. Ft.	12.01	14.69	6.30	12.01	14.69	6.30			
Area Protected	1,000 Ac.	12.14	14.84	6.37	12.14	14.84	6.37			
Cost	$1,000,000	7.60	9.50	3.80	7.60	9.50	3.80			
Recreation and Fish & Wildlife *										
Water Area	1,000 Ac.	6.93	7.41	4.92	3.31	4.14	1.65	3.62	3.27	3.27
Land Area	1,000 Ac.	5.74	7.48	2.58	4.95	6.20	2.46	.79	1.28	.12
Recreation Days	1,000,000 Da.	2.89	3.38	2.17	1.65	2.07	.78	1.24	1.31	1.39
Cost	$1,000,000	9.29	11.00	7.44	5.60	7.00	3.00	3.69	4.00	4.44
Water Supply Municipal & Ind.										
Storage	1,000 Ac. Ft.	8.30			8.30					
Cost	$1,000,000	1.04			1.04					
Quality Control										
Storage	1,000 Ac. Ft.	5.95			5.95					
Cost	$1,000,000	.74			.74					
Irrigation Water										
Storage	1,000 Ac. Ft.	6.06	7.00	.04	2.87	3.31		3.19	3.69	.04
Cost	$1,000,000	.84	.96	.01	.36	.41		.48	.55	.01
Irrigation **										
Land Area	1,000 Ac.	12.29	16.43	.11						
Cost	$1,000,000	1.13	1.51	.01						
Drainage **										
Land Area	1,000 Ac.	21.00	2.63	1.05						
Cost	$1,000,000	3.70	.46	.18						

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	3.29	1,000 Acres
	Outside Potential Watersheds	4.23	1,000 Acres
	Total	7.52	1,000 Acres
2. Water Storage:	In Potential Watersheds	17.47	1,000 Ac. Ft.
	Outside Potential Watersheds	181.58	1,000 Ac. Ft.
	Total	199.05	1,000 Ac. Ft.

* Data shown in outside potential watershed projects includes National Forest developments which may or may not be in potential watersheds.

** Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Salt Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2020	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	64.15	79.73	38.14	24.90	37.35		39.25	42.38	38.14
Pastureland Area	1,000 Ac.	82.35	100.07	33.77	41.70	62.55		40.65	37.52	33.77
Woodland Area	1,000 Ac.	143.51	177.42	79.08	59.70	89.55		83.81	87.87	79.08
Cost	$1,000,000	7.25	8.93	3.77	4.74	4.74		4.09	4.19	3.77
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	37.84	56.76		37.84	56.76				
Sediment Storage	1,000 Ac. Ft.	4.80	7.20		4.80	7.20				
Area Protected	1,000 Ac.	5.37	8.06		5.37	8.06				
Cost	$1,000,000	3.40	5.10		3.40	5.10				
Recreation and Fish & Wildlife										
Water Area	1,000 Ac.	3.64	4.61	.81	2.24	3.37		1.40	1.24	.81
Land Area	1,000 Ac.	3.36	5.06		3.36	5.06				
Recreation Days	1,000,000 Da.	1.51	2.04	.23	1.12	1.69		.39	.35	.23
Cost	$1,000,000	4.52	6.19	.65	3.40	5.20		1.12	.99	.65
Water Supply										
Municipal & Ind.										
Storage	1,000 Ac. Ft.	4.80	2.50		4.80	2.50				
Cost	$1,000,000	.60	.31		.60	.31				
Quality Control										
Storage	1,000 Ac. Ft.	10.20			10.20					
Cost	$1,000,000	1.28			1.28					
Irrigation Water										
Storage	1,000 Ac. Ft.	2.58	2.96	.44	1.17	1.34		1.41	1.62	.44
Cost	$1,000,000	.36	.41	.07	.15	.17		.21	.24	.07
Irrigation *										
Land Area	1,000 Ac.	4.93	6.56	1.27						
Cost	$1,000,000	.46	.61	.12						
Drainage *										
Land Area	1,000 Ac.	8.84	4.43							
Cost	$1,000,000	1.55	.78							

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	3.01	1,000 Acres
	Outside Potential Watersheds	.47	1,000 Acres
	Total	3.48	1,000 Acres
2. Water Storage:	In Potential Watersheds	11.64	1,000 Ac. Ft.
	Outside Potential Watersheds	11.82	1,000 Ac. Ft.
	Total	23.46	1,000 Ac. Ft.

* Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Green Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	362.01	427.72	277.51	154.30	205.59	102.10	207.71	222.13	175.41
Pastureland Area	1,000 Ac.	190.48	224.00	143.00	84.16	112.14	55.69	106.32	111.86	87.31
Woodland Area	1,000 Ac.	407.57	480.13	308.48	177.61	236.62	117.52	229.96	243.51	190.96
Cost	$1,000,000	24.00	28.30	18.22	10.40	13.86	6.88	13.60	14.44	11.34
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	67.14	89.71	44.16	67.14	89.71	44.16			
Sediment Storage	1,000 Ac. Ft.	11.69	15.58	7.74	11.69	15.58	7.74			
Area Protected	1,000 Ac.	55.89	74.47	36.98	55.89	74.47	36.98			
Cost	$1,000,000	11.20	15.00	7.50	11.20	15.00	7.50			
Recreation and Fish & Wildlife										
Water Area	1,000 Ac.	14.57	16.61	9.11	8.27	11.01	5.47	6.30	5.60	3.64
Land Area	1,000 Ac.	12.41	16.52	8.21	12.41	16.52	8.21			
Recreation Days	1,000,000 Da.	5.61	6.82	3.59	4.14	5.51	2.74	1.47	1.41	.85
Cost	$1,000,000	16.80	20.73	10.82	12.60	17.00	8.40	4.20	3.73	2.42
Water Supply										
Municipal & Ind.										
Storage	1,000 Ac. Ft.	10.00			10.00					
Cost	$1,000,000	1.25			1.25					
Quality Control										
Storage	1,000 Ac. Ft.	10.70	3.57		10.70	3.57				
Cost	$1,000,000	1.34	.45		1.34	.45				
Irrigation Water										
Storage	1,000 Ac. Ft.	.46	1.62	1.55	.25	.88	.84	.21	.74	.71
Cost	$1,000,000	.06	.22	.22	.03	.11	.11	.03	.11	.11
Irrigation *										
Land Area	1,000 Ac.	1.12	3.93	3.75						
Cost	$1,000,000	.10	.37	.35						
Drainage *										
Land Area	1,000 Ac.	125.08	29.60	17.08						
Cost	$1,000,000	16.88	4.00	2.30						

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	10.45	1,000 Acres
	Outside Potential Watersheds	10.06	1,000 Acres
	Total	20.51	1,000 Acres
2. Water Storage:	In Potential Watersheds	142.66	1,000 Ac. Ft.
	Outside Potential Watersheds	341.68	1,000 Ac. Ft.
	Total	484.34	1,000 Ac. Ft.

* Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Wabash Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	2,860.49	3,307.99	1,894.80	1,431.78	1,913.23	841.48	1,428.71	1,394.76	1,053.32
Pastureland Area	1,000 Ac.	448.19	517.26	293.74	227.26	303.67	133.57	220.93	213.59	160.17
Woodland Area	1,000 Ac.	703.95	810.05	454.08	363.72	486.02	213.76	340.23	324.03	240.32
Cost	$1,000,000	100.32	115.88	66.07	50.57	67.57	29.72	49.75	48.31	36.35
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	323.67	432.52	190.23	323.67	432.52	190.23			
Sediment Storage	1,000 Ac. Ft.	39.95	53.38	23.47	39.95	53.38	23.47			
Area Protected	1,000 Ac.	231.24	309.00	135.90	231.24	309.00	135.90			
Cost	$1,000,000	59.70	79.70	35.10	59.70	79.70	35.10			
Recreation and Fish & Wildlife *										
Water Area	1,000 Ac.	26.20	36.26	24.43	18.98	25.36	11.16	7.22	10.90	13.27
Land Area	1,000 Ac.	29.88	40.00	19.24	28.40	38.00	16.76	1.48	2.00	2.48
Recreation Days	1,000,000 Da.	12.73	16.92	11.45	9.45	12.65	5.58	3.28	4.27	5.87
Cost	$1,000,000	43.23	57.73	39.06	32.60	43.60	19.20	10.63	14.13	19.86
Water Supply										
Municipal & Ind.										
Storage	1,000 Ac. Ft.	81.75	29.70	20.25	81.75	29.70	20.25			
Cost	$1,000,000	10.22	3.71	2.53	10.22	3.71	2.53			
Quality Control										
Storage	1,000 Ac. Ft.	55.90			55.90					
Cost	$1,000,000	6.99			6.99					
Irrigation Water										
Storage	1,000 Ac. Ft.	37.56	123.82	210.48	24.77	81.66	124.67	12.79	42.16	85.81
Cost	$1,000,000	5.02	16.53	28.45	3.10	10.21	15.58	1.92	6.32	12.87
Irrigation **										
Land Area	1,000 Ac.	75.41	276.63	422.31						
Cost	$1,000,000	7.00	25.45	38.86						
Drainage **										
Land Area	1,000 Ac.	2,190.00	288.22	47.56						
Cost	$1,000,000	280.32	37.20	6.14						

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	27.26	1,000 Acres
	Outside Potential Watersheds	26.15	1,000 Acres
	Total	53.41	1,000 Acres
2. Water Storage:	In Potential Watersheds	430.50	1,000 Ac. Ft.
	Outside Potential Watersheds	988.67	1,000 Ac. Ft.
	Total	1,419.17	1,000 Ac. Ft.

* Data shown in outside potential watershed projects includes National Forest developments which may or may not be in potential watersheds.

** Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Cumberland Subbasin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	348.30	428.25	314.80	101.45	135.16	67.13	246.85	293.09	247.67
Pastureland Area	1,000 Ac.	297.96	366.84	270.69	85.42	113.80	56.52	212.54	253.04	214.17
Woodland Area	1,000 Ac.	1,027.28	1,263.32	929.09	298.60	397.83	197.57	728.68	865.49	731.52
Cost	$1,000,000	41.84	51.46	37.86	12.14	16.17	8.03	29.70	35.29	29.83
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	118.95	158.48	78.70	118.95	158.48	78.70			
Sediment Storage	1,000 Ac. Ft.	14.03	18.69	9.28	14.03	18.69	9.28			
Area Protected	1,000 Ac.	38.05	50.70	25.17	38.05	50.70	25.17			
Cost	$1,000,000	31.20	41.60	20.80	31.20	41.60	20.80			
Recreation and Fish & Wildlife *										
Water Area	1,000 Ac.	20.16	22.68	12.53	10.52	14.12	6.96	9.64	8.56	5.57
Land Area	1,000 Ac.	16.68	22.53	12.24	15.78	21.18	10.44	.90	1.35	1.80
Recreation Days	1,000,000 Da.	8.28	10.02	6.17	5.26	7.06	3.48	3.02	2.96	2.69
Cost	$1,000,000	25.53	31.04	19.27	16.80	22.40	11.20	8.73	8.64	8.07
Water Supply										
Municipal & Ind.										
Storage	1,000 Ac. Ft.	21.00	10.00	2.00	21.00	10.00	2.00			
Cost	$1,000,000	2.63	1.25	.25	2.63	1.25	.25			
Quality Control										
Storage	1,000 Ac. Ft.	11.20			11.20					
Cost	$1,000,000	1.40			1.40					
Irrigation Water										
Storage	1,000 Ac. Ft.	1.12	3.31	2.34	.40	1.18	.84	.72	2.13	1.50
Cost	$1,000,000	.16	.47	.34	.05	.15	.11	.11	.32	.23
Irrigation **										
Land Area	1,000 Ac.	2.30	6.80	4.80						
Cost	$1,000,000	.22	.63	.45						
Drainage **										
Land Area	1,000 Ac.	85.37	34.98	17.37						
Cost	$1,000,000	11.18	4.58	2.27						

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	28.72	1,000 Acres
	Outside Potential Watersheds	80.95	1,000 Acres
	Total	109.67	1,000 Acres
2. Water Storage:	In Potential Watersheds	892.48	1,000 Ac. Ft.
	Outside Potential Watersheds	3,203.29	1,000 Ac. Ft.
	Total	4,095.77	1,000 Ac. Ft.

* Data shown in outside potential watershed projects includes National Forest developments which may or may not be in potential watersheds.

** Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Ohio Minor Tributaries

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	824.52	1,019.04	542.39	341.17	510.79	111.79	483.35	508.25	430.60
Pastureland Area	1,000 Ac.	567.22	699.79	366.17	240.01	359.34	78.64	327.21	340.45	287.53
Woodland Area	1,000 Ac.	1,259.95	1,558.00	833.23	517.99	775.52	169.74	741.96	782.48	663.49
Cost	$1,000,000	66.29	81.92	43.54	27.48	41.14	9.00	38.81	40.78	34.54
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	171.02	256.04	56.04	171.02	256.04	56.04			
Sediment Storage	1,000 Ac. Ft.	25.66	38.42	8.41	25.66	38.42	8.41			
Area Protected	1,000 Ac.	150.73	225.67	49.38	150.73	225.67	49.38			
Cost	$1,000,000	46.45	69.55	15.22	46.45	69.55	15.22			
Recreation and Fish & Wildlife *										
Water Area	1,000 Ac.	34.34	49.31	34.40	16.78	25.12	5.50	17.56	24.19	28.90
Land Area	1,000 Ac.	28.97	42.51	14.70	25.17	37.68	8.25	3.80	4.83	6.45
Recreation Days	1,000,000 Da.	15.10	22.59	15.86	8.39	12.56	2.75	6.71	10.03	13.11
Cost	$1,000,000	50.75	76.74	53.94	28.80	43.20	9.40	21.95	33.54	44.54
Water Supply Municipal & Ind.										
Storage	1,000 Ac. Ft.	18.50			18.50					
Cost	$1,000,000	2.31			2.31					
Quality Control										
Storage	1,000 Ac. Ft.	29.30			29.30					
Cost	$1,000,000	3.66			3.66					
Irrigation Water										
Storage	1,000 Ac. Ft.	2.85	3.33	15.29	1.54	1.80	8.26	1.31	1.53	7.03
Cost	$1,000,000	.39	.46	2.08	.19	.23	1.03	.20	.23	1.05
Irrigation **										
Land Area	1,000 Ac.	12.68	16.22	74.40						
Cost	$1,000,000	1.17	1.49	6.84						
Drainage **										
Land Area	1,000 Ac.	513.74	108.60	48.34						
Cost	$1,000,000	71.92	15.20	6.77						

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	34.39	1,000 Acres
	Outside Potential Watersheds	74.66	1,000 Acres
	Total	109.05	1,000 Acres
2. Water Storage:	In Potential Watersheds	633.56	1,000 Ac. Ft.
	Outside Potential Watersheds	2,340.48	1,000 Ac. Ft.
	Total	2,974.04	1,000 Ac. Ft.

* Data shown in outside potential watershed projects includes National Forest developments which may or may not be in potential watersheds.

** Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

USDA RESOURCE DEVELOPMENT PROGRAM

Total Ohio River Basin

Item	Units	Total			In Watershed Projects			Outside Watershed Projects		
		1980	2000	2020	1980	2000	2020	1980	2000	2020
Land Treatment & Management										
Cropland Area	1,000 Ac.	7,219.66	8,100.02	4,277.68	3,551.94	4,511.89	1,261.12	3,667.72	3,687.13	3,016.56
Pastureland Area	1,000 Ac.	3,211.20	3,676.68	2,061.46	1,423.63	1,757.94	438.67	1,787.57	1,918.74	1,622.79
Woodland Area	1,000 Ac.	7,938.82	9,167.94	5,278.67	3,291.00	4,051.14	879.77	4,647.82	5,116.80	4,398.90
Cost	$1,000,000	459.24	526.10	290.41	206.66	258.03	64.48	252.58	268.07	225.93
Flood Prevention										
Floodwater Storage	1,000 Ac. Ft.	1,342.06	1,661.45	483.14	1,342.06	1,661.45	483.14			
Sediment Storage	1,000 Ac. Ft.	181.75	225.54	63.13	181.75	225.54	63.13			
Area Protected	1,000 Ac.	691.00	899.50	282.28	691.00	899.50	282.28			
Cost	$1,000,000	300.46	373.67	97.73	300.46	373.67	97.73			
Recreation and Fish & Wildlife *										
Water Area	1,000 Ac.	165.5	213.72	138.06	88.82	114.17	34.68	76.69	99.55	104.28
Land Area	1,000 Ac.	154.3	206.95	105.90	133.29	171.38	52.02	21.60	35.57	53.88
Recreation Days	1,000,000 Da.	74.14	98.68	65.28	44.38	57.08	17.30	29.76	41.60	47.98
Cost	$1,000,000	249.63	334.87	221.01	153.88	196.00	52.60	95.75	138.87	163.61
Water Supply										
Municipal & Ind.										
Storage	1,000 Ac. Ft.	341.32	78.75	22.25	341.32	78.75	22.25			
Cost	$1,000,000	42.69	9.84	2.78	42.69	9.84	2.78			
Quality Control										
Storage	1,000 Ac. Ft.	211.81	12.78		211.81	12.78				
Cost	$1,000,000	26.50	1.61		26.50	1.61				
Irrigation Water										
Storage	1,000 Ac. Ft.	73.18	227.68	265.10	45.48	147.18	137.81	27.70	80.50	127.29
Cost	$1,000,000	9.87	30.47	36.33	5.70	18.41	17.23	4.17	12.06	19.10
Irrigation **										
Land Area	1,000 Ac.	165.00	559.00	645.80						
Cost	$1,000,000	15.29	41.43	59.42						
Drainage **										
Land Area	1,000 Ac.	4,212.89	677.51	194.81						
Cost	$1,000,000	567.13	92.29	27.13						

Other Upstream Development Opportunities

1. Water Surface Areas:	In Potential Watersheds	180.15	1,000 Acres
	Outside Potential Watersheds	379.97	1,000 Acres
	Total	560.12	1,000 Acres
2. Water Storage:	In Potential Watersheds	3,246.34	1,000 Ac. Ft.
	Outside Potential Watersheds	12,969.32	1,000 Ac. Ft.
	Total	16,215.66	1,000 Ac. Ft.

* Data shown in outside potential watershed projects includes National Forest developments which may or may not be in potential watersheds.

** Irrigation and drainage are both within and outside watershed projects and generally in the same distribution as project areas are to the overall subbasin area. See Table 44.

X - CONCLUSIONS

1. With resource development expected to move ahead at a high rate, agricultural lands appear to be available to meet expected demands until about 2000. Beyond this date the situation changes to marginal to deficient and an increase in land utilization in other water resource regions appears necessary. Shifts between major land uses in accordance with capabilities of the land may be helpful also.

2. An increase in the multiple use of land involving recreation, fish and wildlife, forests and agriculture must be employed to meet the increasing requirements for land.

3. The opportunities for developing water and related land resources in the upstream areas are generally good to excellent. Reservoir sites for multiple use storage are available and appear feasible.

4. Water yields appear to be adequate for farm and rural non-farm demands. The quality is generally adequate.

5. Water supply for recreation and fish and wildlife is exceeded by demands at present. Water-based recreation and fish and wildlife developments in many of the Basin's streams and some of its ponded waters are impeded by pollution.

6. Proper land use, treatment and management are essential to the conservation, production, and sediment reduction needs of the Basin. In areas where water resource projects are planned, the rate of accomplishment of land treatment measures should be accelerated. New techniques and programs are needed to control erosion in expanding urban areas, other construction areas and areas of chronically high silt production.

7. Many shifts into and out of forest cover are expected to occur. While a net gain is projected, some of the best timber land is expected to be lost to development. This expected loss along with the present timber quality problem could further impact the need for increases in the production of high quality timber.

8. Forest products output and employment are projected to increase substantially. Nine out of ten acres of forest land are privately owned. This land should provide increasing supplies of wood, water, wildlife and recreation, if properly developed and used.

9. Progress has been made in the upstream watershed program, including needed land treatment and land use changes. However, the rate these projects are being installed falls far short of meeting the water and related land resource development needs in upstream areas of the Basin. The projected rate of upstream watershed project development by 1980 would provide a fourfold increase in flood prevention storage capacity, ninefold increase in water surface areas for recreation and fish and wildlife, and more than a twentyfold increase

in storage capacity for municipal and industrial water supply. Present limitations on Federal cost-sharing for municipal and industrial water supply is limiting needed development in rural areas.

10. In order to meet projected needs, upstream watershed projects should also provide by 1980 an estimated 212,000 acre feet of storage capacity for water quality control at a cost of about $26.5 million. Because this need is not being met at this time, new approaches must be taken. Present limitations on Federal cost-sharing and operational authority appear to be major obstacles.

11. Intensified development of flood prevention, irrigation and drainage appears necessary to meet future demands for food and fiber production.

12. Without further resource development, flood damages are expected to more than double by 2020 if the projected rate of growth in the flood plain occurs. However, flood plain regulation in connection with development programs could have a beneficial effect toward the reduction of flood damages.

13. Continuing and more detailed study by subbasins is needed for proper formulation and coordination of water resource plans in the Basin. Project studies are also necessary to determine justification and allocation of available resources to specific purposes.

XI - RECOMMENDATIONS

1. That the following subbasins be scheduled for more detailed studies for formulation, coordination and project identification:

   a. Detailed comprehensive River Basin Studies (Type II):

      Kentucky
      Big Sandy
      Monongahela
      Allegheny
      Salt
      Licking
      Guyandotte

   b. State sponsored coordinated surveys (Type IV):

      Green
      Cumberland
      Muskingum
      Scioto
      Great Miami

2. That consideration be given to authorization for funding and construction of Type II and Type IV plans on a subbasin basis in order that a more complete, adequate and timely schedule of project installation can be secured.

3. That solutions to the constraints, limitations and inadequacies of present laws and programs, both State and Federal, be found to permit more adequate development and funding of needed multiple purpose watershed projects in upstream areas.

4. That programs dealing with proper land use and application of soil, water and plant conservation are necessary and must be accelerated in order to protect the Basin's productive capacity and reduce sedimentation of reservoirs.

5. That close coordination of local, State and Federal interests in the planning and development of land and water resources be maintained for the maximum benefit of all concerned.

6. Since the well being of all the people is considered the over-riding determinant in river basin planning, it is imperative that they be fully informed of the needs and opportunities for future developments in order to properly exercise their privileges and discharge their responsibilities.

Table 1. Production of major crops, livestock and livestock products, Ohio River Basin and subareas, 1959

	Subarea	Crops				Livestock & Livestock Products 3/
		Food 1/	Feed 2/	Roughage 2/	Total	
		(Thousand tons)				
A	Allegheny	26.5	218.2	840.6	1,085.3	678.4
B	Monongahela	35.0	54.8	356.2	446.0	215.3
C	Pittsburgh SMSA	12.2	81.5	326.0	419.7	175.1
D	Beaver	27.0	169.0	390.4	586.4	213.2
E	Upper Ohio	17.1	119.8	385.2	521.1	244.9
F	Muskingum	151.3	762.9	1,093.5	2,007.7	667.9
G	Kanawha-Little Kanawha	9.6	90.4	589.2	689.2	417.8
H	Ohio-Huntington	8.0	170.1	266.6	444.7	173.4
I	Scioto	393.8	1,456.6	794.1	2,644.5	475.8
J	Guyandotte-Big Sandy-Little Sandy	.2	34.2	34.5	68.9	56.2
K	Ohio-Cincinnati	46.9	332.2	358.2	737.3	311.7
L	Little Miami-Great Miami	350.2	1,792.8	938.7	3,081.7	661.2
M	Licking-Kentucky-Salt	12.4	397.5	914.6	1,324.5	683.1
N	Ohio-Louisville	27.9	222.7	295.1	545.7	226.7
O	Lower Ohio-Evansville	321.4	900.7	407.3	1,629.4	247.4
P	Green	62.1	553.1	574.8	1,190.0	565.7
Q	White	893.9	2,982.0	1,184.9	5,060.8	940.5
R	Wabash	2,159.0	5,933.1	1,639.3	9,731.4	1,166.1
S	Cumberland	65.1	699.3	822.9	1,587.3	854.1
	TOTAL	4,618.6	16,970.9	12,212.1	33,801.6	8,974.5

Source: 1959 Census of Agriculture

1/ Excludes fruits and vegetables
2/ Excludes crops of minor importance
3/ Includes dairy products and eggs

Table 2. Income from sales of crops, livestock and livestock products Ohio River Basin and subareas, 1959

	Subarea	Crops 1/	Livestock & Livestock Products 2/	Total
		(Million Dollars)		
A	Allegheny	7.0	86.7	93.7
B	Monongahela	1.1	28.0	29.1
C	Pittsburgh SMSA	1.6	24.3	25.9
D	Beaver	3.8	30.3	34.1
E	Upper Ohio	2.4	28.6	31.0
F	Muskingum	18.6	100.2	118.8
G	Kanawha-Little Kanawha	5.1	47.8	52.9
H	Ohio-Huntington	8.6	23.8	32.4
I	Scioto	45.3	96.4	141.7
J	Guyandotte-Big Sandy-Little Sandy	4.5	3.1	7.6
K	Ohio-Cincinnati	24.0	38.1	62.1
L	Little Miami-Great Miami	49.9	127.1	177.0
M	Licking-Kentucky-Salt	105.8	99.5	205.3
N	Ohio-Louisville	15.3	35.8	51.1
O	Lower Ohio-Evansville	44.3	53.6	97.9
P	Green	48.5	60.4	108.9
Q	White	98.9	202.8	301.7
R	Wabash	422.9	271.1	694.0
S	Cumberland	63.0	100.3	163.3
	TOTAL	970.6	1,457.9	2,428.5

Source: 1959 Census of Agriculture

1/ Excludes pasture, fruits and vegetables and crops of minor importance.

2/ Includes dairy products and eggs.

Table 3. Rural farm population and employment, Ohio River Basin and sub-areas, 1959

	Sub-area	Rural Farm Employment	Rural Farm Population
		(Thousand persons)	
A	Allegheny	12.5	50.2
B	Monongahela	8.1	38.2
C	Pittsburgh SMSA	7.5	20.2
D	Beaver	6.1	29.8
E	Upper Ohio	8.9	39.6
F	Muskingum	22.8	95.9
G	Kanawha-Little Kanawha	18.7	100.1
H	Ohio-Huntington	11.0	49.7
I	Scioto	21.6	76.6
J	Guyandotte-Big Sandy-Little Sandy	3.8	31.8
K	Ohio-Cincinnati	15.5	60.2
L	Little Miami - Great Miami	28.1	100.4
M	Licking-Kentucky-Salt	46.6	183.9
N	Ohio-Louisville	11.9	49.1
O	Lower Ohio-Evansville	19.4	73.9
P	Green	30.1	130.9
Q	White	35.5	168.6
R	Wabash	59.0	230.8
S	Cumberland	52.9	230.1
	TOTAL	420.0	1,760.0

Source: 1960 Census of Population

Table 4. Volume of growing stock and sawtimber on commercial forest land in the Ohio River Basin by sub-areas and stand-size classes, January 1, 1963.

Sub-area	Growing Stock			Sawtimber		
	Total	Poletimber	Sawtimber	Total	In sawtimber stands	In other stands
	(Million cubic feet)			(Million board feet)		
Allegheny	5,059	2,503	2,556	10,022	8,480	1,542
Monongahela	2,538	1,103	1,435	6,084	5,062	1,022
Pittsburg SMSA	495	202	293	1,174	813	361
Beaver	362	164	198	879	686	193
Upper Ohio	1,368	496	872	4,410	3,714	696
Muskingum	813	290	523	3,242	2,787	455
Kanawha-Little Kanawha	6,156	2,495	3,661	15,702	13,027	2,675
Ohio-Huntington	1,708	729	979	4,924	4,114	810
Scioto	488	173	315	1,839	1,622	217
Guyandotte-Big Sandy-Little Sandy	2,642	947	1,695	8,227	7,349	878
Ohio-Cincinnati	420	175	245	1,456	1,295	161
Little Miami-Great Miami	360	94	266	1,680	1,605	75
Licking-Kentucky-Salt	2,264	928	1,336	7,795	6,563	1,232
Ohio-Louisville	573	267	306	1,714	1,442	272
Lower Ohio-Evansville	1,144	476	668	3,821	3,334	487
Green	1,427	638	789	4,545	3,875	670
White	1,140	424	716	4,536	3,964	572
Wabash	957	300	657	4,178	3,782	396
Cumberland	3,984	1,583	2,401	12,825	10,670	2,155
TOTAL	33,898	13,987	19,911	99,053	84,184	14,869

Source: "Basic Forest Resource Statistics for the Ohio River Basin" - U. S. Forest Service, as appended 3/29/66.

Table 5. Timber growth of growing stock on commercial forest land in the Ohio River Basin by sub-areas in 1952 and 1962, and projections 1980 - 2020

Sub-area	1952			1962			PROJECTIONS 1980			2000			2020		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	GROWING STOCK - MILLION CUBIC FEET														
Allegheny	117.3	8.1	109.2	181.3	9.0	172.3	151	10	141	182	13	169	214	14	200
Monongahela	93.4	7.2	86.2	107.2	4.7	102.5	77	5	72	93	6	87	109	7	102
Pittsburg SMSA	11.8	0.3	11.5	18.4	0.3	18.1	15	-	15	18	-	18	21	-	21
Beaver	9.0	0.3	8.7	13.1	0.3	12.8	11	-	11	13	-	13	15	-	15
Upper Ohio	45.1	2.3	42.8	54.7	2.0	52.7	41	2	39	50	2	48	59	2	57
Muskingum	22.6	-	22.6	27.8	-	27.8	25	-	25	30	-	30	35	-	35
Kanawha-Little Kanawha	227.4	18.0	209.4	270.5	14.5	256.0	186	12	174	224	15	209	264	18	246
Ohio-Huntington	54.2	4.5	49.7	63.7	5.5	58.2	51	3	48	62	3	59	73	4	69
Scioto	13.9	0.7	13.2	15.8	0.8	15.0	15	1	14	18	1	17	21	1	20
Guyandotte-Big Sandy-Little Sandy	93.1	3.8	89.3	114.8	3.5	111.3	80	3	77	96	3	93	113	4	109
Ohio-Cincinnati	11.9	0.5	11.4	13.9	0.7	13.2	13	-	13	15	-	15	18	-	18
Little Miami-Great Miami	10.0	-	10.0	11.8	-	11.8	11	-	11	13	-	13	15	-	15
Licking-Kentucky-Salt	75.7	7.7	68.0	92.2	9.8	82.4	68	7	61	83	9	74	97	10	87
Ohio-Louisville	19.2	1.3	17.9	24.3	1.6	22.7	17	1	16	21	1	20	24	1	23
Lower Ohio-Evansville	38.2	0.4	37.8	48.9	0.4	48.5	34	-	34	42	-	42	49	-	49
Green	47.7	0.7	47.0	61.1	0.8	60.3	43	1	42	52	1	51	61	1	60
White	37.6	0.6	37.0	45.7	0.8	44.9	34	-	34	42	-	42	49	1	48
Wabash	31.4	-	31.4	38.4	-	38.4	29	-	29	35	-	35	41	-	41
Cumberland	130.8	17.4	113.4	166.5	22.7	143.8	120	14	106	145	18	127	171	21	150
TOTAL	1,090.3	73.8	1,016.5	1,370.1	77.4	1,292.7	1,021	59	962	1,234	72	1,162	1,449	84	1,365

Source: "Basic Forest Resource Statistics for the Ohio River Basin" - U. S. Forest Service, as appended 3/29/66.

Table 6. Timber cut from growing stock on commercial forest land in the Ohio River Basin by sub-areas in 1952 and 1962, and projections 1980 - 2020

Sub-area	1952			1962			PROJECTIONS 1980			2000			2020		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	GROWING STOCK - MILLION CUBIC FEET														
Allegheny	43.3	8.9	34.4	58.5	12.9	45.6	89	6	83	162	11	151	214	14	200
Monongahela	23.3	1.6	21.7	24.0	3.6	20.4	46	3	43	83	5	78	109	7	102
Pittsburg SMSA	4.0	0.3	3.7	5.2	0.5	4.7	9	-	9	16	-	16	21	-	21
Beaver	3.3	0.3	3.0	4.1	0.4	3.7	7	-	7	12	-	12	15	-	15
Upper Ohio	13.8	0.4	13.4	14.7	1.5	13.2	24	1	23	45	2	43	59	2	57
Muskingum	9.5	-	9.5	10.2	-	10.2	15	-	15	27	-	27	35	-	35
Kanawha-Little Kanawha	64.7	7.4	57.3	62.0	10.3	51.7	111	7	104	200	13	187	264	18	246
Ohio-Huntington	17.8	0.5	17.3	21.2	2.1	19.1	30	2	28	55	3	52	73	4	69
Scioto	5.6	0.1	5.5	6.6	0.4	6.2	9	1	8	16	1	15	21	1	20
Guyandotte-Big Sandy-Little Sandy	34.3	1.2	33.1	26.1	1.7	24.4	48	2	46	86	3	83	113	4	109
Ohio-Cincinnati	4.8	-	4.8	5.8	0.3	5.5	8	-	8	13	-	13	18	-	18
Little Miami- Great Miami	4.2	-	4.2	4.8	-	4.8	7	-	7	12	-	12	15	-	15
Licking-Kentucky-Salt	41.8	3.4	38.4	23.5	2.1	21.4	41	4	37	74	8	66	97	10	87
Ohio-Louisville	10.7	0.6	10.1	6.3	0.4	5.9	10	-	10	19	1	18	24	1	23
Lower Ohio-Evansville	21.6	0.2	21.4	11.0	0.2	10.8	20	-	20	38	-	38	49	-	49
Green	26.8	0.3	26.5	14.0	0.2	13.8	26	1	25	47	1	46	61	1	60
White	17.6	-	17.6	11.3	0.3	11.0	20	-	20	38	-	38	49	1	48
Wabash	14.9	-	14.9	9.4	-	9.4	17	-	17	31	-	31	41	-	41
Cumberland	98.6	12.3	86.3	70.0	7.6	62.4	71	8	63	130	16	114	171	21	150
TOTAL	406.6	37.5	423.1	388.7	44.5	344.2	608	35	573	1,104	64	1,040	1,449	84	1,365

Source: "Basic Forest Resource Statistics for the Ohio River Basin" - U. S. Forest Service, as appended 3/29/66.

Table 7. Timber products output in the Ohio River Basin by sub-areas, 1952 and 1962, and projections 1980 - 2020

Sub-area	Sawlogs, veneer logs and minor industrial products 1/					Pulpwood					Fuelwood				
	1952	1962	1980	2000	2020	1952	1962	1980	2000	2020	1952	1962	1980	2000	2020
	(Thousand cubic feet)					(Thousand cords)					(Thousand cords)				
Allegheny	51,591	43,748	55,020	84,416	94,959	88	172	373	833	1,321	266	241	184	148	120
Monongahela	19,099	14,889	18,915	28,879	32,355	34	81	164	363	572	148	134	105	89	72
Pittsburg SMSA	6,201	5,258	6,680	10,198	11,426	-	-	-	-	-	21	19	15	13	10
Beaver	4,272	3,700	4,701	7,177	8,040	-	-	-	-	-	27	18	14	12	10
Upper Ohio	15,170	13,140	16,694	25,487	28,554	-	3	6	13	21	93	63	49	42	34
Muskingum	7,398	6,408	8,141	12,429	13,925	6	41	83	184	290	65	44	34	29	24
Kanawha-Little Kanawha	60,944	47,510	60,358	92,152	103,243	32	76	154	341	537	389	352	275	234	192
Ohio-Huntington	7,539	6,530	8,296	12,666	14,191	24	182	369	817	1,288	135	91	71	60	49
Scioto	3,278	2,839	3,607	5,506	6,169	6	45	91	202	319	42	28	22	19	15
Guyandotte-Big Sandy-Little Sandy	27,855	21,715	27,587	42,119	47,188	4	10	20	44	69	160	145	113	96	78
Ohio-Cincinnati	4,291	3,717	4,722	7,209	8,077	3	22	44	97	153	37	25	19	17	14
Little Miami-Great Miami	3,159	2,736	3,476	5,307	5,947	3	23	47	104	164	30	20	16	13	11
Licking-Kentucky-Salt	29,715	18,521	23,530	35,924	40,247	3	9	18	40	63	410	164	128	109	89
Ohio-Louisville	8,094	5,045	6,409	9,785	10,963	-	1	2	4	6	109	44	34	29	24
Lower Ohio-Evansville	12,184	7,594	9,648	14,728	16,502	7	19	39	86	135	192	77	60	51	42
Green	18,204	11,346	14,414	22,007	24,656	-	-	-	-	-	244	98	77	65	53
White	10,762	9,133	11,603	17,715	19,847	5	33	67	148	234	139	96	75	64	52
Wabash	7,866	6,675	8,480	12,947	14,505	5	39	79	175	276	115	79	62	52	43
Cumberland	62,167	50,840	64,589	98,611	110,479	77	39	79	175	276	939	316	246	210	172
TOTAL	359,789	281,344	356,870	545,262	611,273	297	795	1,635	3,626	5,724	3,561	2,054	1,599	1,352	1,104

1/ Minor industrial products include cooperage logs, poles, piling, mine timbers, posts, chemical wood, box bolts and a miscellaneous assortment of similar items.

Source: Basic Forest Resource Statistics for the Ohio River Basin - U. S. Forest Service, as appended 3/29/66.

Table 8. Timber inventory of growing stock on commercial forest land in the Ohio River Basin by sub-areas in 1952 and 1962, and projections 1980 - 2020

Sub-area	1952			1962			PROJECTIONS 1980			2000			2020		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	GROWING STOCK - MILLION CUBIC FEET														
Allegheny	3,594	340	3,254	5,059	318	4,741	6,951	455	6,496	7,586	496	7,090	7,741	507	7,234
Monongahela	1,698	161	1,537	2,538	151	2,387	3,487	207	3,280	3,806	227	3,579	3,883	231	3,652
Pittsburg SMSA	345	12	333	495	11	484	680	15	665	742	16	726	757	17	740
Beaver	268	11	257	362	10	352	497	14	483	543	15	528	554	15	539
Upper Ohio	1,019	52	967	1,368	54	1,314	1,879	74	1,805	2,051	81	1,970	2,093	82	2,011
Muskingum	697	1	696	813	1	812	1,117	1	1,116	1,219	2	1,217	1,244	2	1,242
Kanawha-Little Kanawha	4,258	414	3,844	6,156	404	5,752	8,458	555	7,903	9,230	606	8,624	9,420	617	8,803
Ohio-Huntington	1,344	84	1,260	1,708	93	1,615	2,347	128	2,219	2,561	139	2,422	2,613	142	2,471
Scioto	418	12	406	488	15	473	670	21	649	732	23	709	747	23	724
Guyandotte-Big Sandy-Little Sandy	1,920	89	1,831	2,642	93	2,549	3,630	128	3,502	3,961	139	3,822	4,043	143	3,900
Ohio-Cincinnati	360	9	351	420	11	409	577	15	562	630	17	613	643	17	626
Little Miami- Great Miami	309	-	309	360	-	360	495	-	495	540	-	540	551	-	551
Licking-Kentucky-Salt	1,808	188	1,620	2,264	228	2,036	3,110	313	2,797	3,395	342	3,053	3,464	349	3,115
Ohio-Louisville	457	31	426	573	37	536	787	51	736	859	55	804	877	57	820
Lower Ohio-Evansville	910	9	901	1,144	11	1,133	1,572	15	1,557	1,715	16	1,699	1,751	17	1,734
Green	1,136	17	1,119	1,427	20	1,407	1,961	28	1,933	2,140	30	2,110	2,184	31	2,153
White	980	8	972	1,140	11	1,129	1,566	15	1,551	1,709	16	1,693	1,744	17	1,727
Wabash	824	1	823	957	1	956	1,315	1	1,314	1,435	2	1,433	1,464	2	1,462
Cumberland	3,148	370	2,778	3,984	480	3,504	5,474	660	4,814	5,974	720	5,254	6,096	734	5,362
TOTAL	25,493	1,809	23,684	33,898	1,949	31,949	46,573	2,696	43,877	50,828	2,942	47,886	51,869	3,003	48,866

Source: "Basic Forest Resource Statistics for the Ohio River Basin" - U. S. Forest Service, as appended 3/29/66.

Table 9. Estimated employment in the Ohio River Basin by sub-areas in timber based manufacturing industries 1952 and 1962 and projections 1980-2020

Sub-area	1952			1962			1980			2000			2020		
	Total	Lumber & wood products 1/	Pulp, paper & allied products 2/	Total	Lumber & wood products 1/	Pulp, paper & allied products 2/	Total	Lumber & wood products 1/	Pulp, paper & allied products 2/	Total	Lumber & wood products 1/	Pulp, paper & allied products 2/	Total	Lumber & wood products 1/	Pulp, paper & allied products 2/
							(Number)								
Allegheny	6,054	4,983	1,071	5,556	3,590	1,966	5,797	3,301	2,496	7,099	3,645	3,454	6,219	2,936	3,283
Monongahela	3,730	3,462	268	3,308	3,082	226	3,274	2,984	290	3,753	3,366	387	3,159	2,791	368
Pittsburg SMSA	5,507	1,060	4,447	6,664	997	5,667	8,241	965	7,276	10,793	1,089	9,704	10,119	903	9,216
Beaver	1,063	842	221	1,128	653	475	1,242	632	610	1,527	713	814	1,364	591	773
Upper Ohio	2,604	1,181	1,423	2,177	688	1,489	2,578	666	1,912	3,302	752	2,550	3,045	623	2,422
Muskingum	6,871	2,300	4,571	6,745	910	5,835	8,373	881	7,492	10,986	994	9,992	10,313	824	9,489
Kanawha-Little Kanawha	5,430	5,379	51	5,076	4,989	87	4,942	4,830	112	5,598	5,449	149	4,660	4,519	141
Ohio-Huntington	1,705	1,641	64	1,386	1,143	243	1,419	1,107	312	1,666	1,249	417	1,431	1,035	396
Scioto	6,093	1,051	5,042	6,976	764	6,212	8,714	739	7,975	11,470	834	10,636	10,793	691	10,102
Guyandotte-Big Sandy-Little Sandy	2,033	2,033	-	1,389	1,389	-	1,344	1,344	-	1,517	1,517	-	1,258	1,258	-
Ohio-Cincinnati	7,002	1,641	5,361	7,114	1,163	5,951	8,767	1,126	7,641	11,460	1,270	10,190	10,731	1,053	9,678
Little Miami- Great Miami	12,423	1,748	10,675	15,320	1,048	14,272	19,339	1,015	18,324	25,583	1,145	24,438	24,159	949	23,210
Licking-Kentucky-Salt	2,038	2,038	-	1,690	1,539	151	1,683	1,490	193	1,939	1,681	258	1,639	1,394	245
Ohio-Louisville	4,278	3,437	841	4,936	3,383	1,553	5,269	3,275	1,994	6,354	3,695	2,659	5,588	3,063	2,525
Lower Ohio-Evansville	1,933	1,670	263	1,801	1,013	788	1,993	981	1,012	2,455	1,106	1,349	2,199	917	1,282
Green	1,457	1,457	-	1,646	1,571	75	1,618	1,521	97	1,845	1,716	129	1,544	1,422	122
White	7,943	3,428	4,515	9,934	2,726	7,208	11,894	2,639	9,255	15,320	2,977	12,343	14,192	2,469	11,723
Wabash	5,661	2,692	2,969	7,391	3,248	4,143	8,464	3,145	5,319	10,642	3,548	7,094	9,680	2,942	6,738
Cumberland	7,959	7,199	760	7,915	6,239	1,676	8,190	6,040	2,150	9,682	6,815	2,867	8,374	5,651	2,723
TOTAL	91,784	49,242	42,542	98,152	40,135	58,017	113,141	38,681	74,460	142,991	43,561	99,430	130,467	36,031	94,436

1/ Includes logging camps engaged in cutting timber and pulpwood, sawmills, veneer mills, shingle mills, cooperage stock mills, planing mills, plywood mills engaged in producing lumber and wood basic materials; and establishments engaged in manufacturing finished articles made entirely or mainly of wood (Major group 24 as defined by the Bureau of Census).

2/ Includes establishments manufacturing pulp primarily from wood and from rags and other fibers, converting these pulps into paper or board; and the manufacture of paper and paperboard into converted products such as coated paper, paper bags, paperboard boxes, and envelopes (Major group 26 as defined by the Bureau of Census).

Source: "Basic Forest Resource Statistics for the Ohio River Basin" - U. S. Forest Service, as appended 3/29/66.

Table 10. Major Land Use Ohio River Basin and Subareas, 1959

	Subarea	Total Geographic Area 1/	Water Area			Land Area					
			Total	40 Acres or more 1/	Less Than 40 acres 2/	Total 3/	Urban & Built-up 3/	Cropland 2/	Pasture 2/	Forest 4/	Other 5/
		Thousand Acres									
A	Allegheny	7,574	88	56	32	7,486	302	1,332	732	4,322	798
B	Monongahela	4,168	41	23	18	4,127	139	529	907	2,334	218
C	Pittsburgh SMSA	1,971	25	18	7	1,946	355	470	260	606	255
D	Beaver	1,855	18	11	7	1,837	219	617	197	564	240
E	Upper Ohio	3,287	35	26	9	3,252	184	575	711	1,503	279
F	Muskingum	5,175	86	77	9	5,089	306	1,749	1,074	1,325	635
G	Kanawha-Little Kanawha	9,190	73	33	40	9,117	233	824	1,764	6,148	148
H	Ohio-Huntington	3,826	48	34	14	3,778	145	599	626	2,214	194
I	Scioto	4,002	23	17	6	3,979	223	2,520	494	638	104
J	Guyandotte-Big Sandy-Little Sandy	3,806	7	1	6	3,799	92	152	222	3,091	242
K	Ohio-Cincinnati	2,657	30	20	10	2,627	294	828	601	770	134
L	Little Miami-Great Miami	4,165	16	7	9	4,149	360	2,694	496	521	78
M	Licking-Kentucky-Salt	7,887	50	6	44	7,837	182	1,434	2,341	3,329	551
N	Ohio-Louisville	2,403	42	34	8	2,361	136	687	372	952	214
O	Lower Ohio-Evansville	4,876	117	90	27	4,759	177	1,986	774	1,426	396
P	Green	5,174	26	1	25	5,148	122	1,712	904	2,038	372
Q	White	8,669	44	15	29	8,625	467	4,602	915	1,917	724
R	Wabash	12,349	88	33	55	12,261	543	8,810	1,159	1,217	532
S	Cumberland	11,387	283	211	72	11,104	436	2,095	1,801	5,874	898
	TOTALS	104,421	1,140	713	427	103,281	4,915	34,215	16,350	40,789	7,012

1/ Bureau of the Census, Land & Water Areas of the United States, 1960.

2/ U. S. Department of Agriculture, National Inventory of Soil and Water Conservation Needs, 1962.

3/ Total geographic area minus total water area.

4/ Calculated as residuals from information assembled in the National Inventory of Soil and Water Conservation Needs. Forest acreages reported here differ somewhat from U. S. Forest Service estimates which are based on the Forest Survey.

5/ National Inventory of Soil and Water Conservation Needs. Includes farmsteads, abandoned land, wildlife areas, crossroad filling stations, rural nonfarm residences, country schools and churches, etc.

Table 11. Use of cropland and pastureland, Ohio River Basin and subareas, 1959

	Subarea	Crops				Pasture	Idle 5/	Total
		Food 1/	Feed 2/	Roughage 3/	Misc. 4/			
		(Thousand Acres)						
A	Allegheny	49	241	711	55	732	276	2,064
B	Monongahela	8	52	205	16	907	247	1,435
C	Pittsburgh SMSA	17	78	144	9	260	223	731
D	Beaver	39	135	137	35	197	270	813
E	Upper Ohio	24	98	205	22	711	227	1,287
F	Muskingum	223	534	456	154	1,074	382	2,823
G	Kanawha-Little Kanawha	17	74	214	102	1,764	417	2,588
H	Ohio-Huntington	15	124	148	26	626	285	1,224
I	Scioto	543	956	353	65	494	603	3,014
J	Guyandotte-Big Sandy-Little Sandy	3	33	29	10	222	76	373
K	Ohio-Cincinnati	80	221	189	25	601	314	1,430
L	Little Miami-Great Miami	469	1,148	382	65	496	630	3,190
M	Licking-Kentucky-Salt	22	302	469	61	2,341	581	3,776
N	Ohio-Louisville	44	184	154	19	372	287	1,060
O	Lower Ohio-Evansville	412	699	216	54	773	605	2,759
P	Green	91	495	350	51	905	724	2,616
Q	White	1,122	1,926	530	113	915	912	5,518
R	Wabash	2,869	3,729	669	229	1,159	1,313	9,968
S	Cumberland	92	645	522	82	1,801	754	3,896
	TOTAL	6,139	11,674	6,083	1,193	16,350	9,126	50,565

1/ Includes wheat, soybeans, dry field beans and potatoes
2/ Corn, oats and barley
3/ Corn silage, alfalfa mixtures, other hay and cropland pasture
4/ Fruits, vegetables, miscellaneous small grain
5/ Cropland acreage reported in the National Inventory of Soil and Water Conservation Needs minus the total acreage of crops reported in the 1959 Census of Agriculture. Includes cropland idled by Government programs, and land planted but not harvested.

SOURCE: National Inventory of Soil and Water Conservation Needs, U. S. Department of Agriculture and Bureau of the Census, U. S. Department of Commerce

Table 12. Area of commercial forest land in the Ohio River Basin by sub-areas and ownership classes, January 1, 1963.

Sub-area	Ownership classes				
	Total	National forest	Other public	Forest industry	Farmer-owned and misc. private
	(Thousand acres)				
Allegheny	4,335	450	387	145	3,353
Monongahela	2,534	251	112	117	2,054
Pittsburg SMSA	584	--	22	--	562
Beaver	468	--	8	--	460
Upper Ohio	1,588	22	11	28	1,527
Muskingum	1,141	18	39	8	1,076
Kanawha-Little Kanawha	6,506	622	94	216	5,574
Ohio-Huntington	2,337	50	126	57	2,104
Scioto	585	19	36	15	515
Guyandotte-Big Sandy-Little Sandy	3,136	9	25	60	3,042
Ohio-Cincinnati	693	--	5	8	680
Little Miami-Great Miami	410	--	--	--	410
Licking-Kentucky-Salt	3,405	140	16	153	3,096
Ohio-Louisville	896	8	50	3	835
Lower Ohio-Evansville	1,355	168	6	15	1,166
Green	1,927	--	30	--	1,897
White	1,932	71	106	5	1,750
Wabash	1,250	--	9	2	1,239
Cumberland	6,180	319	291	336	5,234
TOTAL	41,262	2,147	1,373	1,168	36,574

Source: "Basic Forest Resource Statistics for the Ohio River Basin" - U. S. Forest Service, as appended 3/29/66.

Table 13. Area of commercial forest land in the Ohio River Basin by sub-areas and stocking classes, January 1, 1963.

Subarea	Stocking classes 1/				
	Total	70 percent +	40-70 percent	10-40 percent	Less than 10 percent
	(Thousand acres)				
Allegheny	4,335	3,065	867	173	230
Monongahela	2,534	1,632	676	147	79
Pittsburg SMSA	584	400	145	39	--
Beaver	468	271	149	47	1
Upper Ohio	1,588	1,056	370	109	53
Muskingum	1,141	762	261	97	21
Kanawha-Little Kanawha	6,506	3,741	1,920	712	133
Ohio-Huntington	2,337	1,513	566	207	51
Scioto	585	369	146	64	6
Guyandotte-Big Sandy-Little Sandy	3,136	2,269	639	157	71
Ohio-Cincinnati	693	311	222	123	37
Little Miami-Great Miami	410	227	105	71	7
Licking-Kentucky-Salt	3,405	2,588	494	37	286
Ohio-Louisville	896	529	280	70	17
Lower Ohio-Evansville	1,355	726	443	120	66
Green	1,927	1,319	457	42	109
White	1,932	813	856	253	10
Wabash	1,250	523	481	184	62
Cumberland	6,180	3,378	2,218	437	147
TOTAL	41,262	25,492	11,295	3,089	1,386

1/ Percent of stocking with present or potential growing stock trees.

Source: "Basic Forest Resource Statistics for the Ohio River Basin" - U. S. Forest Service, as appended 3/29/66

Table 14. Area of commercial forest land in the Ohio River Basin by sub-areas and stand-size classes, January 1, 1963.

Sub-area	Stand-size class				
	Total	Sawtimber	Poletimber	Seedlings and saplings	Non-stocked
	(Thousand acres)				
Allegheny	4,335	1,576	1,742	787	230
Monongahela	2,534	1,063	813	579	79
Pittsburg SMSA	584	145	225	214	--
Beaver	468	160	164	143	1
Upper Ohio	1,588	770	479	286	53
Muskingum	1,141	518	440	162	21
Kanawha-Little Kanawha	6,506	2,889	2,112	1,372	133
Ohio-Huntington	2,337	1,053	837	396	51
Scioto	585	315	205	59	6
Guyandotte-Big Sandy-Little Sandy	3,136	1,610	883	572	71
Ohio-Cincinnati	693	264	277	115	37
Little Miami-Great Miami	410	241	118	44	7
Licking-Kentucky-Salt	3,405	1,117	1,386	616	286
Ohio-Louisville	896	381	363	135	17
Lower Ohio-Evansville	1,355	592	476	221	66
Green	1,927	800	750	268	109
White	1,932	857	746	319	10
Wabash	1,250	668	329	191	62
Cumberland	6,180	2,534	1,946	1,553	147
TOTAL	41,262	17,553	14,291	8,032	1,386

Source: "Basic Forest Resource Statistics for the Ohio River Basin" - U. S. Forest Service, as appended 3/29/66

Table 15. Present status of strip-mining operations in the Ohio River Basin by subareas

	Subarea	Surface Area Disturbed (Acres)	Estimated Surface Area Rehabilitated 1/ (Acres)
A	Allegheny	81,250	23,600
B	Monongahela	86,881	28,531
C	Pittsburgh SMSA	59,070	30,070
D	Beaver	30,625	12,456
E	Upper Ohio	56,985	32,379
F	Muskingum	124,010	86,539
G	Kanawha-Little Kanawha	79,360	13,132
H	Ohio-Huntington	22,797	16,915
I	Scioto	2,614	1,617
J	Guyandotte-Big Sandy-Little Sandy	43,687	9,621
K	Licking-Kentucky-Salt	12,647	6,670
O	Lower Ohio-Evansville	32,076	25,231
P	Green	36,113	18,000
Q	White	45,878	43,948
R	Wabash	18,195	15,868
S	Cumberland	10,646	3,225
	TOTAL	742,834	367,802

1/ Figures compiled from best sources available and indicates acreages on which rehabilitation work has been accomplished. This does not necessarily mean that rehabilitation work is adequate. In most areas, additional study and research is needed to determine accurate figures on acreages needing rehabilitation as well as the practices required to return these areas to productive capacity with minimal sediment production and acid mine wastes.

Table 16. Production of food and feed crops and crop roughages, Ohio River Basin and sub-areas, 1980, 2000 and 2020

	Sub-area	1980 Food Crops 1/	1980 Feed Crops 2/	1980 Roughage Crops 2/	1980 Total	2000 Food Crops 1/	2000 Feed Crops 2/	2000 Roughage Crops 2/	2000 Total	2020 Food Crops 1/	2020 Feed Crops 2/	2020 Roughage Crops 2/	2020 Total
		(Thousand tons)											
A	Allegheny	25.3	212.8	1,251.7	1,489.8	53.2	261.2	1,294.2	1,608.6	73.4	398.7	1,330.6	1,802.7
B	Monongahela	4.3	43.4	314.5	362.2	64.8	88.3	459.6	612.7	131.2	131.7	1,425.3	1,688.2
C	Pittsburgh SMSA	13.2	45.1	430.3	488.6	48.1	52.4	429.2	529.7	77.8	57.9	427.1	562.8
D	Beaver	14.1	117.9	389.2	521.2	19.1	158.3	468.7	646.1	24.2	239.9	528.9	793.0
E	Upper Ohio	15.9	82.9	436.9	535.7	111.2	123.2	612.9	847.3	189.7	163.8	789.8	1,143.3
F	Muskingum	153.3	850.8	1,389.3	2,393.4	420.0	1,443.2	1,411.2	3,274.4	587.3	1,832.7	1,444.6	3,864.6
G	Kanawha-Little Kanawha	6.3	258.5	625.4	890.2	65.4	261.5	1,230.8	1,557.7	84.3	264.7	1,575.2	1,924.2
H	Ohio-Huntington	9.4	109.8	304.8	424.0	146.5	124.9	457.2	728.6	221.9	143.1	723.8	1,088.8
I	Scioto	587.0	2,715.7	1,412.2	4,714.9	820.7	3,891.3	758.9	5,470.9	1,241.0	4,692.2	486.2	6,419.4
J	Guyandotte-Big Sandy-Little Sandy	.1	58.5	34.7	93.3	1,281.0	41.6	130.2	1,452.8	2,257.3	31.9	224.6	2,513.8
K	Ohio-Cincinnati	121.7	255.6	393.0	770.3	121.7	215.3	751.0	1,088.0	123.1	197.4	1,007.2	1,327.7
L	Little Miami- Great Miami	486.4	3,501.0	1,768.2	5,755.6	932.8	4,269.3	888.7	6,090.8	1,327.4	5,721.1	234.9	7,283.4
M	Licking-Kentucky-Salt	7.1	290.7	1,064.5	1,362.3	21.3	358.9	130.1	510.3	31.8	423.7	151.8	607.3
N	Ohio-Louisville	76.5	204.9	540.3	821.7	85.8	139.6	523.2	748.6	94.2	89.2	513.8	697.2
O	Lower Ohio-Evansville	1,160.4	795.8	465.1	2,421.3	1,501.3	225.8	756.8	2,483.9	1,753.8	90.1	1,108.8	2,952.7
P	Green	227.9	615.6	653.6	1,497.1	306.7	321.0	888.2	1,515.9	356.1	147.9	1,256.3	1,760.3
Q	White	1,730.1	4,018.7	1,867.3	7,616.1	1,993.1	4,879.9	1,923.4	8,796.4	2,112.0	5,850.0	2,019.8	9,981.8
R	Wabash	3,655.7	9,860.5	2,525.3	16,041.5	3,670.1	12,534.0	2,689.0	18,893.1	3,530.1	15,233.7	2,801.7	21,565.5
S	Cumberland	53.7	746.9	999.1	1,799.7	267.4	522.5	1,258.9	2,048.8	434.3	275.3	1,720.4	2,430.0
	TOTAL	8,348.4	24,785.1	16,865.4	49,998.9	11,930.2	29,912.2	17,062.2	58,904.6	14,650.9	35,985.0	19,770.8	70,406.7

Source: ERS Report, "Agricultural Activity in the Ohio River Basin, 1980-2010: A Projective Study

1/ Excludes fruits and vegetables
2/ Excludes crops of minor importance

Table 17. Projected production of crops, livestock and livestock products, Ohio River Basin and subareas, 1980, 2000 and 2020

	Subarea	1980		2000		2020	
		Crops 1/	Livestock & Livestock Products 2/	Crops 1/	Livestock & Livestock Products 2/	Crops 1/	Livestock & Livestock Products 2/
		(Thousand tons)					
A	Allegheny	1,489.8	374.6	1,608.6	681.6	1,802.7	995.0
B	Monongahela	362.2	221.8	612.7	388.1	1,688.2	544.2
C	Pittsburgh SMSA	488.6	146.2	529.7	211.6	562.8	271.3
D	Beaver	521.2	178.4	646.1	252.8	793.0	320.3
E	Upper Ohio	535.7	205.1	847.3	320.0	1,143.3	436.6
F	Muskingum	2,393.4	711.4	3,274.4	959.9	3,864.6	1,209.2
G	Kanawha-Little Kanawha	890.2	399.4	1,557.7	680.2	1,924.2	950.7
H	Ohio-Huntington	424.0	171.0	728.6	293.8	1,088.8	426.5
I	Scioto	4,714.9	663.0	5,470.9	898.4	6,419.4	1,137.8
J	Guyandotte-Big Sandy-Little Sandy	93.3	65.5	1,452.8	116.7	2,513.8	168.1
K	Ohio-Cincinnati	770.3	327.1	1,088.0	472.1	1,327.7	616.2
L	Little Miami-Great Miami	5,755.6	983.8	6,090.8	1,064.9	7,283.4	1,151.3
M	Licking-Kentucky-Salt	1,362.3	860.4	510.3	1,018.6	607.3	1,177.3
N	Ohio-Louisville	821.7	304.1	748.6	417.5	697.2	522.4
O	Lower Ohio-Evansville	2,421.3	353.3	2,483.9	392.0	2,952.7	428.1
P	Green	1,497.1	618.7	1,515.9	731.4	1,760.3	840.9
Q	White	7,616.1	1,243.1	8,796.4	1,655.9	9,981.8	2,070.2
R	Wabash	16,041.5	2,065.8	18,893.1	2,897.7	21,565.5	3,730.3
S	Cumberland	1,799.7	917.5	2,048.8	1,163.1	2,430.0	1,410.8
	TOTAL	49,998.9	10,810.2	58,904.6	14,616.3	70,406.7	18,407.2

1/ Excludes pasture, fruits, vegetables and crops of minor importance.
2/ Includes dairy products and eggs.

Source: ERS Report, "Agricultural Activity in the Ohio River Basin, 1980-2010: A Projective Study" and unpublished ERS studies.

Table 18. Projected rural farm population and employment, Ohio River Basin and sub-areas, 1980, 2000 and 2020

	Sub-area	Rural Farm Population			Farm Employment		
		1980	2000	2020	1980	2000	2020
		(Thousand persons)					
A	Allegheny	32.7	28.5	25.2	7.7	6.5	6.1
B	Monongahela	27.7	21.8	16.7	4.7	4.1	3.6
C	Pittsburgh SMSA	10.9	7.6	6.1	2.8	2.1	1.7
D	Beaver	20.9	17.3	7.6	3.6	2.9	1.8
E	Upper Ohio	22.0	19.0	17.1	3.8	3.3	2.9
F	Muskingum	80.7	27.4	17.3	17.3	11.2	6.8
G	Kanawha-Little Kanawha	62.5	46.8	38.2	9.8	8.0	6.7
H	Ohio-Huntington	22.9	22.1	18.9	3.5	3.3	3.1
I	Scioto	67.6	45.4	38.5	14.3	11.2	8.1
J	Guyandotte-Big Sandy-Little Sandy	10.6	10.2	8.9	1.3	1.2	1.1
K	Ohio-Cincinnati	28.3	22.7	16.8	6.0	5.0	4.2
L	Little Miami- Great Miami	93.6	64.8	40.1	19.8	12.5	6.3
M	Licking-Kentucky-Salt	73.8	45.4	30.2	15.3	12.5	7.3
N	Ohio-Louisville	32.8	41.7	26.3	6.1	4.2	2.8
O	Lower Ohio-Evansville	49.6	34.3	19.5	9.7	7.0	4.3
P	Green	59.3	43.1	31.8	11.9	7.9	5.2
Q	White	139.0	75.1	39.2	28.4	19.8	12.5
R	Wabash	212.8	143.9	78.2	49.3	37.2	24.8
S	Cumberland	91.5	71.8	40.4	16.6	12.5	7.9
	TOTAL	1,139.2	788.9	517.0	231.9	172.4	117.2

Source: Adapted from data in ERS Report, "Agricultural Activity in the Ohio River Basin, 1980-2010: A Projective Study."

Table 19. Upstream flood plain land use by sub-basins

Sub-basin	Cropland (Acres)	(%)	Pasture (Acres)	(%)	Woodland (Acres)	(%)	Idle (Acres)	(%)	Other 1/ (Acres)	(%)	Total (Acres)
Allegheny	11,954	13	14,712	16	39,539	43	19,310	21	6,437	7	91,952
Monongahela	15,347	29	11,642	22	11,113	21	5,821	11	8,996	17	52,919
Beaver	1,446	8	3,254	18	8,316	46	1,446	8	3,616	20	18,078
Muskingum	90,335	50	45,168	25	12,647	7	19,874	11	12,647	7	180,671
Little Kanawha	11,100	51	3,700	17	3,917	18	2,176	10	871	4	21,764
Hocking	26,562	59	9,455	21	4,052	9	2,701	6	2,251	5	45,021
Kanawha	15,934	21	22,003	29	5,000	7	759	1	32,178	42	75,874
Guyandotte	5,190	28	1,113	6	3,522	19	3,522	19	5,190	28	18,537
Big Sandy	15,848	47	2,698	8	1,686	5	2,360	7	11,127	33	33,719
Scioto	66,543	69	12,537	13	9,644	10	3,858	4	3,858	4	96,440
Little Miami	10,598	46	3,226	14	3,456	15	2,074	9	3,686	16	23,040
Great Miami	50,418	53	19,977	21	14,269	15	2,854	3	7,610	8	95,128
Licking	18,276	57	6,413	20	962	3	962	3	5,450	17	32,063
Kentucky	27,302	64	8,532	20	2,986	7	2,560	6	1,280	3	42,660
Salt	10,065	64	3,774	24	1,101	7	472	3	315	2	15,727
Green	116,668	50	63,001	27	35,001	15	11,667	5	7,000	3	233,337
Wabash	819,990	71	103,942	9	161,688	14	34,648	3	34,648	3	1,154,916
Cumberland	82,395	47	57,852	33	14,025	8	8,765	5	12,272	7	175,309
Ohio River Minor Tributaries	281,339	48	134,808	23	76,196	13	29,306	5	64,473	11	586,122
TOTAL	1,677,310	56	527,807	18	409,120	14	155,135	5	223,905	7	2,993,277

1/ Includes urban, farmsteads and roads

Source: SCS studies

Table 20. Average annual flood damages for upstream areas

Sub-basin	Natural Damages ($1,000)							Modified Damages ($1,000) 1/						
	Crop & Pasture	Other Agri.	Transportation Facilities	Urban	Sediment & Erosion	Indirect 2/	Total	Crop & Pasture	Other Agri.	Transportation Facilities	Urban	Sediment & Erosion	Indirect 2/	Total
Allegheny	205	30	145	856	10	220	1,466	66	14	113	780	4	181	1,158
Monongahela	112	36	331	2,950	7	370	3,806	85	35	308	2,817	6	333	3,584
Beaver	11	9	110	547	0	104	781	10	9	109	484	0	90	702
Muskingum	1,460	251	256	800	29	284	3,089	1,411	248	230	800	29	273	2,991
Little Kanawha	48	60	120	508	5	69	828	41	63	105	506	2	63	780
Hocking	305	37	36	92	6	50	526	223	32	28	61	4	34	382
Kanawha	120	134	676	1,841	1	420	3,192	114	131	659	1,735	0	398	3,037
Guyandotte	43	0	219	871	0	129	1,262	43	0	219	871	0	129	1,262
Big Sandy	213	20	117	1,100	4	151	1,605	213	20	117	1,100	4	151	1,605
Scioto	1,181	96	34	452	23	179	1,965	1,181	96	34	452	23	179	1,965
Little Miami	274	23	5	67	5	38	412	274	23	5	67	5	38	412
Great Miami	1,210	80	147	616	19	202	2,274	1,167	79	145	584	15	193	2,183
Licking	432	35	29	103	8	59	666	430	35	29	103	8	59	664
Kentucky	410	46	57	167	10	68	758	404	45	56	167	10	68	750
Salt	191	38	5	20	9	21	284	176	18	4	20	3	21	242
Green	1,752	220	135	133	50	235	2,525	1,555	188	98	94	41	203	2,179
Wabash	13,834	483	397	50	99	1,455	16,318	13,656	472	385	40	91	1,432	16,076
Cumberland	1,905	269	577	833	331	634	4,549	1,845	261	542	748	305	613	4,314
Ohio River Minor Tributaries	4,749	379	612	2,723	61	805	9,329	4,502	368	564	2,553	50	738	8,775
TOTAL	28,464	2,255	4,017	14,729	677	5,493	55,635	27,396	2,137	3,750	13,982	600	5,196	53,061

1/ Modified by Soil Conservation Service flood control projects constructed, under construction and those approved for operations as of July 1, 1965.
2/ Indirect damages include interruption of travel due to road damage, interruption of public utility service, inconvenience and hardships in repairing and replacing equipment and loss of business income.

Source: SCS studies

Table 21. Average annual flood damage for projected conditions of economic development in upstream areas

Subbasin	1965 Project Development 1/	1980	2000	2020
	(Dollars in thousands)			
Allegheny	1,158	1,447	2,041	2,826
Monongahela	3,584	4,445	5,993	7,916
Beaver	702	821	1,063	1,393
Muskingum	2,991	3,768	5,565	7,511
Little Kanawha	780	1,039	1,421	1,956
Hocking	382	428	772	1,211
Kanawha	3,037	4,104	5,558	7,556
Guyandotte	1,262	1,394	1,672	2,085
Big Sandy	1,605	1,746	2,102	2,607
Scioto	1,965	2,829	4,181	5,585
Little Miami	412	630	926	1,237
Great Miami	2,183	3,245	4,684	6,220
Licking	664	793	977	1,165
Kentucky	750	920	1,171	1,443
Salt	242	281	334	383
Green	2,179	2,478	3,062	3,844
Wabash	16,076	21,698	29,257	37,215
Cumberland	4,314	6,330	7,545	9,190
Ohio River Minor Tributaries	8,775	9,878	12,561	15,252
TOTAL	53,061	68,274	90,885	116,595

Source: SCS Studies

1/ Damages after authorized projects as of July 1, 1965 - projected long-term prices.

Table 22. Economic potential for agricultural irrigation, Ohio River Basin and sub-areas, 1980, 2000 and 2020 1/

Sub-area	Present		Economic Potential in: 1980		2000		2020	
	Specialty Crops	Field Crops	Specialty Crops	Field Crops	Specialty Crops	Field Crops	Specialty Crops	Field Crops
	(Thousand Acres)							
A Allegheny	.4	--	2.0	.1	3.1	.1	4.2	.3
B Monongahela	.2	--	.8	.1	1.3	.1	1.8	.1
C Pittsburgh SMSA	.1	--	1.6	.1	2.5	.1	3.3	.1
D Beaver	.5	--	.8	.1	1.3	.1	1.8	.7
E Upper Ohio	.3	--	1.8	.1	2.8	.1	3.8	.1
F Muskingum	2.6	--	3.3	3.1	5.1	17.9	6.9	28.9
G Kanawha-Little Kanawha	2.1	--	2.8	.1	4.5	.1	6.3	.1
H Ohio-Huntington	.7	--	2.2	.1	3.7	.2	5.0	.2
I Scioto	.7	--	3.4	18.8	5.1	110.1	6.7	160.1
J Guyandotte-Big Sandy-Little Sandy	.6	--	.7	.1	1.0	.1	1.5	.1
K Ohio-Cincinnati	1.1	--	2.4	6.1	4.9	12.8	6.8	72.0
L Little Miami-Great Miami	.6	--	3.3	21.9	5.2	127.6	6.9	184.9
M Licking-Kentucky-Salt	5.2	--	7.6	24.7	12.8	50.8	18.8	44.5
N Ohio-Louisville	.7	--	2.3	2.8	4.2	5.8	5.7	16.7
O Lower Ohio-Evansville	1.3	--	1.5	.1	3.1	.1	4.4	9.4
P Green	1.0	--	2.0	.1	5.8	.1	8.7	.1
Q White	1.3	--	16.0	21.9	23.8	127.3	31.1	270.2
R Wabash	7.6	--	18.4	36.5	27.3	191.0	35.2	455.0
S Cumberland	3.0	--	5.2	.1	12.0	.1	16.8	.1
TOTAL	30.0	20.0 2/	78.1	136.9	129.5	644.5	175.7	1,243.6

1/ Economic Potential for Agricultural Irrigation for each Projection Year is a gross estimate which includes existing irrigation.

2/ Subarea breakdown not available.

Source: Unpublished ERS studies.

Table 23. Gross water requirements to satisfy the economic potential for irrigation, Ohio River Basin and sub-areas, present and projected 1980, 2000 and 2020 (Based on average and driest year of record) 1/

	Estimated Present Use				1980				2000				2020			
	Specialty Crops		Field Crops		Specialty Crops		Field Crops		Specialty Crops		Field Crops		Specialty Crops		Field Crops	
	Avg. Yr.	Driest Yr.	Avg. Yr.	Driest Yr.	Avg. Yr.	Driest Yr.	Avg. Yr.	Driest Yr.	Avg. Yr.	Driest Yr.	Avg. Yr.	Driest Yr.	Avg. Yr.	Driest Yr.	Avg. Yr.	Driest Yr.
	(Thousand Acre Feet)															
A Allegheny	.2	.3	--	--	1.2	1.7	.1	.1	1.7	2.4	.1	.1	2.2	3.1	.2	.3
B Monongahela	.1	.2	--	--	.5	.8	.1	.2	.7	1.2	.1	.2	1.0	1.7	.1	.2
C Pittsburgh SMSA	.1	.2	--	--	1.0	1.7	.1	.2	1.4	2.4	.1	.2	1.7	2.9	.1	.2
D Beaver	.3	.4	--	--	.5	.6	.1	.1	.7	.9	.1	.1	1.0	1.3	.4	.5
E Upper Ohio	.2	.3	--	--	1.1	1.8	.1	.2	1.5	2.4	.1	.2	2.0	3.2	.1	.2
F Muskingum	1.6	2.1	--	--	2.0	2.7	1.5	2.7	2.8	3.8	9.0	12.1	3.7	5.0	15.6	20.9
G Kanawha-Little Kanawha	1.3	2.2	--	--	1.7	2.9	.1	.2	2.5	4.3	.1	.2	3.3	4.4	.1	.2
H Ohio-Huntington	.4	.6	--	--	1.3	2.1	.1	.2	2.0	3.2	.1	.2	2.6	4.1	.1	.2
I Scioto	.4	.6	--	--	2.0	3.1	9.2	3.1	2.8	4.3	55.0	84.2	3.6	5.5	86.5	132.3
J Guyandotte-Big Sandy-Little Sandy	.4	.7	--	--	.3	.5	.1	.2	.6	.2	.1	.2	.8	1.4	.1	.2
K Ohio-Cincinnati	.7	1.0	--	--	1.4	2.0	3.0	4.3	2.7	3.9	6.4	9.2	3.6	5.2	38.9	55.6
L Little Miami-Great Miami	.4	.7	--	--	2.0	3.3	10.7	17.6	2.9	4.8	63.8	104.6	3.7	6.1	99.8	163.7
M Licking-Kentucky-Salt	3.1	5.3	--	--	4.3	7.3	12.1	20.6	7.0	11.9	25.4	43.2	10.0	17.0	24.0	40.8
N Ohio-Louisville	.4	.7	--	--	1.4	2.4	1.4	2.4	2.3	3.9	2.9	4.9	3.0	5.0	9.0	15.1
O Lower Ohio-Evansville	.8	1.4	--	--	.9	1.6	.1	.2	1.7	3.0	.1	.2	2.3	4.1	5.1	9.0
P Green	.6	1.1	--	--	1.2	2.1	.1	.2	3.2	5.7	.1	.2	4.6	8.2	.1	.2
Q White	.8	1.2	--	--	9.6	14.1	10.7	15.7	13.1	19.3	63.6	93.5	16.5	24.3	145.9	214.5
R Wabash	4.6	6.0	--	--	11.0	14.3	17.9	23.3	15.0	19.5	95.5	124.2	18.7	24.3	245.7	319.4
S Cumberland	1.8	2.9	--	--	3.1	5.0	.1	.2	6.6	10.6	.1	.2	8.9	14.3	.1	.2
TOTAL	18.2	27.9	2/	16.8 2/	46.5	70.0	67.6	91.7	71.2	107.7	322.7	477.9	93.2	141.1	671.9	973.7

1/ Water requirements for each projection year is a gross estimate which includes existing irrigation water use and is based on 75 percent application efficiency. Does not include storage or abnormal transmission losses.
2/ Sub-area breakdown not available.

Source: ERS and SCS studies

Table 24. Agricultural Land Drainage, Present and Economic Potential, Ohio River Basin and subareas 1980, 2000 and 2020 1/

	Subarea	Presently Drained	Economic Potential in: 1980	2000	2020
		---000 Acres---			
A	Allegheny	81	128	137	143
B	Monongahela	84	129	138	148
C	Pittsburgh SMSA	68	84	86	88
D	Beaver	29	126	145	160
E	Upper Ohio	111	140	145	147
F	Muskingum	306	497	530	543
G	Kanawha-Little Kanawha	93	160	174	183
H	Ohio-Huntington	69	103	110	118
I	Scioto	1,226	1,619	1,686	1,711
J	Guyandotte-Big Sandy-Little Sandy	10	22	24	27
K	Ohio-Cincinnati	335	491	520	532
L	Little Miami-Great Miami	1,414	1,856	1,930	1,994
M	Licking-Kentucky-Salt	32	72	77	79
N	Ohio-Louisville	95	150	161	167
O	Lower Ohio-Evansville	579	880	950	976
P	Green	122	223	247	262
Q	White	2,104	2,881	3,024	3,126
R	Wabash	4,214	5,621	5,890	6,011
S	Cumberland	63	166	188	202
	TOTAL	11,035	15,348	16,162	16,617

1/ Economic potential for agricultural drainage for each projection year is a gross estimate which includes existing drainage.

Source: Unpublished ERS studies

Table 25. Needs for water for livestock and rural farm domestic uses, Ohio River Basin and sub-areas, present and projected 1980, 2000 and 2020

	Sub-area	Livestock				Rural farm domestic			
		Million gallons per day needed in:				Million gallons per day needed in:			
		Present	1980	2000	2020	Present	1980	2000	2020
A	Allegheny	4.47	3.96	6.85	9.58	1.43	1.15	1.36	1.59
B	Monongahela	3.12	1.70	4.10	6.50	1.40	1.25	1.35	1.45
C	Pittsburgh SMSA	2.16	1.64	2.32	3.04	.67	.45	.44	.42
D	Beaver	2.66	1.78	2.80	3.88	.89	.76	.73	.70
E	Upper Ohio	3.50	1.95	3.69	5.40	1.30	.89	1.05	1.20
F	Muskingum	8.23	8.06	11.80	15.50	2.58	3.15	2.99	2.52
G	Kanawha-Little Kanawha	6.35	3.61	7.43	11.30	3.17	2.38	2.52	2.65
H	Ohio-Huntington	2.63	1.65	3.39	5.12	1.50	.80	.98	1.15
I	Scioto	6.52	10.33	14.51	18.80	1.87	2.07	2.15	2.20
J	Guyandotte-Big Sandy-Little Sandy	1.09	.55	1.25	1.93	1.20	.47	.59	.73
K	Ohio-Cincinnati	3.63	3.33	5.50	7.57	1.68	1.02	1.04	1.06
L	Little Miami- Great Miami	8.03	13.37	16.80	20.40	2.46	2.93	2.47	2.10
M	Licking-Kentucky-Salt	8.58	8.60	11.10	13.56	4.73	2.42	2.14	1.83
N	Ohio-Louisville	2.71	3.49	4.01	4.56	1.29	1.10	.92	.75
O	Lower Ohio-Evansville	3.87	4.46	6.17	7.80	2.00	1.68	1.47	1.29
P	Green	5.90	6.22	8.30	10.40	3.29	1.91	1.92	1.92
Q	White	11.58	16.90	25.00	33.00	4.43	4.61	3.85	3.10
R	Wabash	15.60	29.05	47.20	65.20	5.93	7.01	6.39	5.93
S	Cumberland	10.59	8.62	11.70	14.70	6.11	3.02	3.01	2.99
	TOTAL	111.22	129.25	193.92	258.24	47.93	39.07	37.37	35.58

Source: Adapted from ERS Report "Agricultural Activity in the Ohio River Basin, 1980-2010: A Projective Study"

Table 26. Water needs for rural nonfarm domestic uses[1], Ohio River Basin and sub-areas, present and projected, 1980, 2000, and 2020

	Sub-area	Million gallons per day needed in: Present	1980	2000	2020
A	Allegheny	44.8	50.1	53.7	59.3
B	Monongahela	31.0	39.0	45.2	52.4
C	Pittsburgh SMSA	36.8	43.0	49.0	54.4
D	Beaver	24.8	25.2	29.2	33.0
E	Upper Ohio	19.1	22.7	25.2	28.1
F	Muskingum	42.1	42.8	50.6	58.0
G	Kanawha-Little Kanawha	43.1	58.3	68.3	78.7
H	Ohio-Huntington	20.2	24.6	27.5	29.9
I	Scioto	20.9	22.6	27.5	32.6
J	Guyandotte-Big Sandy-Little Sandy	28.4	28.6	29.1	30.7
K	Ohio-Cincinnati	18.9	22.4	26.6	30.9
L	Little Miami-Great Miami	34.4	34.8	43.8	54.4
M	Licking-Kentucky-Salt	20.6	37.6	45.4	56.1
N	Ohio-Louisville	14.7	17.3	21.9	27.0
O	Lower Ohio-Evansville	17.4	21.6	25.7	29.8
P	Green	12.5	23.4	30.2	37.5
Q	White	46.1	48.2	60.2	72.8
R	Wabash	45.1	49.8	62.4	75.9
S	Cumberland	37.1	61.2	72.4	92.9
	TOTAL	558.0	673.2	793.9	934.4

1/ Includes urban areas of less than 2,500 population.

Source: Unpublished ERS studies

Table 27. Gross and net acreages of National Forests and Purchase Units in the Ohio River Basin as of December 31, 1964 and projections to 1980, 2000 and 2020

National Forest Unit	Economic Sub-areas in which located	1964		1980		2000		2020	
		Gross 1/	Net 2/	Gross 1/	Net 2/	Gross 1/	Net 2/	Gross 1/	Net 2/
		(Thousand Acres)							
Allegheny	Allegheny	736	473	728	497	900	620	1,000	690
Monongahela	Monongahela; Kanawha- Little Kanawha	1,451	732	2,453	1,158	2,580	1,452	2,580	1,721
Jefferson	Kanawha-Little Kanawha; Guyandotte-Big Sandy-Little Sandy; Licking-Kentucky-Salt	546	181	680	295	680	321	680	335
Cherokee	Kanawha-Little Kanawha	.3	.3	.3	.3	.3	.3	.3	.3
Pisgah	Kanawha-Little Kanawha	38	.4	38	.4	38	.4	38	.4
Yadkin (Purchase Unit)	Kanawha-Little Kanawha	31	0	31	0	31	0	31	0
Wayne	Upper Ohio; Muskingum; Ohio-Huntington; Scioto	1,455	111	1,500	400	1,500	610	1,500	650
Cumberland 3/	Licking-Kentucky-Salt; Cumberland	1,357	460	1,948	862	1,948	1,137	1,948	1,262
Hoosier	Ohio-Louisville; Lower Ohio-Evansville; White	722	123	720	250	720	360	720	430
Shawnee	Lower Ohio-Evansville	497	127	500	200	500	250	500	300
	TOTALS	6,823.3	2,207.7	8,598.3	3,662.7	8,897.3	4,750.7	8,997.3	5,388.7

1/ Total Geographic Area within the National Forest Boundaries

2/ Purchased or acquired by the Government and under National Forest Administration

3/ Changed to Daniel Boone National Forest by Presidential Proclamation on April 11, 1966

Source: U. S. Forest Service

Table 28. Authorized Upstream Watershed Project Data as of July 1, 1965

Sub-basin and Watershed Project	Purpose 1/	Project Area (Sq. Mi.)	Number of Structures	Drainage Area Controlled (Sq. Mi.)	STORAGE Sediment (Ac. Ft.)	STORAGE Floodwater (Ac. Ft.)	STORAGE Other Uses (Ac. Ft.)	STORAGE Total (Ac. Ft.)	Channel Improvements (Miles)
Allegheny									
Mill Run, Pennsylvania	FP,F&WL	12.2	4	8.7	99	2,776	2,716	5,591	
Sandy Creek, Pennsylvania	FP,F&WL	65.6	2	58.8	133	5,349	19,875	25,357	
Conewango Creek, New York	FP,F&WL	297.0	13	68.3	657	10,616	1,700	12,973	30.9
Ischua Creek, New York	FP,F&WL,R	117.0	8	43.8	352	7,557	1,572	9,481	.16
Monongahela									
Little Youghiogheny, Maryland	FP	41.0	6	14.4	223	3,003		3,226	1.6
Dunlap Creek, Pennsylvania	FP,F&WL	16.5	4	8.6	151	1,227	780	2,158	.2
Polk Creek, West Virginia	FP	11.4	8	6.6	253	1,528		1,781	
Upper Deckers Creek, West Virginia	FP	31.1	5	14.6	389	1,651		2,040	7.2
Salem Fork, West Virginia	FP	8.3	7	2.1	27	355		382	
Shooks Run, West Virginia	FP	3.0							.7
Peck's Run, West Virginia	FP	12.8							6.0
Beaver									
Saul-Mathay, Pennsylvania	FP	6.1	2	3.0	29	585		614	
Little Shenango River, Pennsylvania	FP,R	113.7	8	60.8	252	7,246	2,505	10,003	
Muskingum									
Chippewa, Ohio	FP,R	188.0	9	39.0	406	6,294	2,767	9,467	33.2
Little Kanawha									
Bond's Creek, West Virginia	FP,F&WL	14.7	1	.5	11	86	147	244	5.8
Saltlick Creek, West Virginia	FP	49.5	5	19.7	305	3,954		4,259	
Hocking									
Rush Creek, Ohio	FP,M&I,R	236.7	23	96.4	6,238	9,716	2,252	18,206	22.1
Upper Hocking, Ohio	FP	49.1	8	24.4	355	8,710		9,065	5.5
Kanawha									
Brush Creek, West Virginia	FP,M&I	34.8	14	16.6	280	3,238	153	3,671	5.9
Dave's Fork-Christian's Fork, West Virginia	FP	6.5	3	2.4	43	502		545	1.2
Marlin Run, West Virginia	FP	1.6	1	1.2	15	272		287	
Back Creek, Virginia	FP	34.9							11.1
Big Ditch Run, West Virginia	FP,R	9.0	1	1.2	47	176	372	595	5.0
Great Miami									
Dick's Creek-Little Muddy Creek, Ohio	FP	69.7	6	22.4	184	5,161		5,345	17.7
East Fork Buck Creek, Ohio	FP,F&WL	10.3	5	3.0	82	289	101	472	3.7
Licking									
Twin Creek, Kentucky	FP	27.2	2	1.7	35	330		365	3.7
Kentucky									
Red River, Kentucky	FP	24.0							6.0
Salt									
Plum Creek, Kentucky	FP	37.0	12	11.0	304	2,163		2,467	21.0
Green									
Beaver Creek, Kentucky	FP	52.9	1	33.5	529	3,749		4,278	
Big Muddy Creek, Kentucky	FP	101.8	5	39.5	1,255	5,924		7,179	17.5
Big Reddy Creek, Kentucky	FP	41.2	2	11.1	199	1,425		1,624	9.3
Caney Creek, Kentucky	FP,R,M&I	152.0	10	68.2	2,217	13,075	258	15,550	20.0
East Fork Pond River, Kentucky	FP	218.2	17	115.3	2,559	13,794		16,353	53.4
Line Creek, Tennessee & Kentucky	FP	63.0	5	30.8	678	8,215		8,893	38.0
Mud River, Kentucky	FP,R,M&I	375.0	26	131.8	2,910	17,795	16,137	36,842	15.6
Short Creek, Kentucky	FP	38.0	3	14.3	351	2,268		2,619	4.5
Upper Green River, Kentucky	FP	38.0	5	3.7	76	646		722	12.0
Upper North Fork Rough River, Kentucky	FP	40.0	2	5.5	94	1,028		1,122	10.0
Valley Creek, Kentucky	FP,M&I,R	90.6	4	20.4	769	3,750	1,600	6,119	
West Fork Pond River, Kentucky	FP,M&I	82.7	9	35.2	1,218	4,923	80	6,221	25.0

1/ FP - flood prevention; M&I - municipal and industrial water supply; R - recreation; F&WL - fish and wildlife development

Table 28. Authorized Upstream Watershed Project Data as of July 1, 1965

Sub-basin and Watershed Project	Purpose 1/	Project Area (Sq. Mi.)	Number of Structures	Drainage Area Controlled (Sq. Mi.)	STORAGE Sediment (Ac. Ft.)	STORAGE Floodwater (Ac. Ft.)	STORAGE Other Uses (Ac. Ft.)	STORAGE Total (Ac. Ft.)	Channel Improvements (Miles)
Wabash									
Upper Wabash, Ohio	FP	126.0	3	19.3	370	2,101		2,471	38.2
Busseron, Indiana	FP,R,M&I	236.8	26	112.1	3,778	21,829	14,029	39,636	52.9
Stucker Fork, Indiana	FP	134.0	16	67.9	1,091	10,980		12,071	25.6
Dewitt Creek, Indiana	FP	14.1	2	6.2	168	695		863	2.3
Bachelor Run, Indiana	FP	36.7							20.6
Kickapoo Creek, Indiana	FP	38.6							9.3
Lattas Creek, Indiana	FP	55.9							22.4
Little Wea Creek, Indiana	FP	18.7							8.6
Prairie Creek-Vigo, Indiana	FP	29.8	3	15.1	635	2,063		2,698	4.9
Prairie Creek-Daviess, Indiana	FP,R	138.5	11	38.6	1,275	3,771	174	5,220	33.5
Elk Creek, Indiana	FP,F&WL	28.2	8	7.3	39	841	494	1,374	10.8
French Lick, Indiana	FP,F&WL	34.2	4	11.9	267	2,892	1,302	4,461	5.1
Boggs Creek, Indiana	FP	63.7	2	49.2	141	4,658		4,799	8.2
Twin Rush, Indiana	FP,M&I	43.9	3	22.2	416	5,242	3,020	8,678	9.9
Mill Creek-Fulton, Indiana	FP	90.0							16.3
Scattering Fork, Illinois	FP	114.1							37.6
Cumberland									
Buck Creek, Kentucky	FP	120.1	3	89.1	975	6,740		7,715	10.0
North Fork of Little River, Kentucky	FP,M&I,F&WL	58.7	4	26.8	490	4,934	3,019	8,443	
Proctor Creek, Tennessee	FP	13.2							5.2
Pine Creek, Tennessee	FP,F&WL,M&I	26.2	4	6.1	77	1,466	655	2,198	6.0
Meadow Creek, Kentucky	FP	15.4							7.4
Jennings Creek, Tennessee	FP	72.1	13	29.3	930	5,442		6,372	18.0
Ohio Minor Tributaries									
Middle Fork of Anderson, Indiana	FP,R	108.4	6	52.8	583	9,816	434	10,833	34.4
Canoe Creek, Kentucky	FP	119.8	10	13.6	420	1,682		2,102	29.5
Humphrey-Clanton, Kentucky	FP	107.1	5	26.1	528	4,529		5,057	25.0
Little Kentucky River, Kentucky	FP,R	71.2	6	29.1	504	5,163	1,699	7,366	
Upper Grave Creek, West Virginia	FP,M&I	7.7	7	2.0	39	387	129	555	3.6
West Fork Duck Creek, Ohio	FP,R,M&I	106.8	8	39.9	2,618	8,838	4,937	16,393	10.9
Crab Orchard, Kentucky	FP	151.4	13	35.8	651	3,987		4,638	31.6
Cypress Creek, Kentucky	FP,R	50.7	3	3.0	103	578	389	1,070	6.0
Donaldson, Kentucky	FP,R	73.5	7	33.0	500	5,161	543	6,204	31.1
Upper Tradewater, Kentucky	FP	93.7	8	53.0	2,189	7,459		9,648	13.9
Little Cache, Illinois	FP	70.3	5	25.9	892	3,447		4,339	16.0
Harmon Creek, West Virginia & Pennsylvania	FP,F&WL	38.0	14	19.7	532	3,127	981	4,640	

1/ FP - flood prevention; M&I - municipal and industrial water supply; R - recreation; F&WL - fish and wildlife development

Source: SCS Watershed Work Plan data

Table 29. Summary of authorized upstream watershed projects - Structural measures, as of July 1, 1965

Subbasin	Number of Projects	Total Area of Watersheds (Sq. Mi.)	Number of Dams	Drainage Area Above Dams (Sq. Mi.)	STORAGE				SURFACE AREA		Channel Improvements (Miles)	Total Estimated Flood Prevention Cost ($1,000)	Flood Plain Area (Acres)
					Sediment (Ac. Ft.)	Floodwater 1/ (Ac. Ft.)	Other Uses 2/ (Ac. Ft.)	Total (Ac. Ft.)	Sediment Pool (Acres)	Flood Pool 1/ (Acres)			
Allegheny	4	492	27	180	1,241	26,298	25,863	53,402	296	6,050	31	3,488	12,096
Monongahela	7	124	30	46	1,043	7,764	780	9,587	195	785	16	3,339	2,328
Beaver	2	120	10	64	281	7,831	2,505	10,617	33	1,575	-	1,726	540
Muskingum	1	188	9	39	406	6,294	2,767	9,467	107	944	33	2,030	10,300
Little Kanawha	2	64	6	20	316	4,040	147	4,503	40	213	6	984	1,168
Hocking	2	286	31	121	6,593	18,426	2,252	27,271	517	2,660	28	5,237	14,063
Kanawha	5	87	19	21	385	4,188	525	5,098	85	459	23	2,072	2,437
Great Miami	2	80	11	26	266	5,450	101	5,817	33	380	22	1,562	2,650
Licking	1	27	2	2	35	330	-	365	14	57	4	42	817
Kentucky	1	24	-	-	-	-	-	-	-	-	6	165	336
Salt	1	37	12	11	304	2,163	-	2,467	70	258	21	343	1,253
Green	12	1,293	89	509	12,855	73,592	18,075	104,522	2,520	8,577	206	12,968	52,419
Wabash	16	1,253	78	350	8,180	55,072	19,019	82,271	1,819	8,781	306	14,850	48,301
Cumberland	6	306	24	151	2,472	18,582	3,674	24,728	323	2,084	48	4,200	8,385
Ohio River Minor Tributaries	12	999	92	334	9,659	54,174	9,112	72,945	2,190	6,850	211	13,175	47,952
TOTAL	74	5,380	440	1,874	44,036	284,204	84,820	413,060	8,242	39,673	961	66,181	205,045

1/ To crest of emergency spillway.
2/ Storage for beneficial uses other than flood prevention.

Source: SCS, Watershed Work Plans

Table 30. Multiple purpose structures in authorized watershed projects 1/

Subbasin	NUMBER OF DAMS	STORAGE VOLUME BY PURPOSE 2/ (ac. ft.)				ACREAGE		ESTIMATED RECREATION DAYS PROVIDED	POPULATION SERVED BY WATER SUPPLY
		FP	M&I	R	F&WL	Total Land Area Provided	Water Surface		
Allegheny	9	14,084		972	24,891	8,468	3,779	260,900	
Monongahela	1	308			780	150	150	10,000	
Beaver	3	2,655		2,505		2,208	1,033	18,160	
Muskingum	3	2,087		2,767		910	346	161,750	
Little Kanawha	1	97			147	16	12	1,200	
Hocking	4	2,596	1,416	836		347	309	31,800	6,800
Kanawha	2	843	153	372		704	81	50,000	6,000
Great Miami	1	35			101	15	14	1,500	
Green	6	9,627	3,335	14,750		2,286	1,280	46,900	19,830
Wabash	10	9,090	3,726	13,631	1,662	3,506	1,415	237,400	7,500
Cumberland	5	3,991	2,242		1,432	503	355	90,000	202,500
Ohio River Minor Tributaries	7	7,756	1,016	7,415	681	2,285	603	241,325	5,346
TOTAL	52	53,169	11,888	43,248	29,694	21,398	9,377	1,150,935	247,976

1/ Includes projects constructed, under construction and those approved for operations as of July 1, 1965.

2/ Indicates both primary and secondary purposes; FP - flood prevention; M&I - municipal and industrial water supply; R - recreation, including fishing; F&WL - fish and wildlife development.

Source: SCS, Watershed Work Plans

Table 31. National Forests' present status of water and related land resource developments

Ohio River Basin

National Forest	Economic Sub-areas in which located	Water Areas Developed (Surface Acres)	Adjacent Land Areas Developed (Acres)	Purposes for which developed
Allegheny	Allegheny	457	118	Municipal Water-Recreation-Wildlife & Fish-Flood Control. Does not include COE Allegheny Reser.
Monongahela	Monongahela; Kanawha-Little Kanawha	258	380	Primarily Wildlife & Fish - 1 Municipal Water impoundment.
Jefferson	Kanawha-Little Kanawha; Guyandotte-Big Sandy-Little Sandy; Licking-Kentucky-Salt	675	163	Municipal Water-Flood Control-Recreation-Wildlife & Fish
Cherokee	Kanawha-Little Kanawha	0	0	
Pisgah	Kanawha-Little Kanawha	0	0	
Yadkin Purchase Unit	Kanawha-Little Kanawha	0		
Wayne	Upper Ohio; Muskingum; Ohio-Huntington; Scioto	140	95	Recreation
Cumberland	Licking-Kentucky-Salt; Cumberland	5,150	100	Municipal Water-Recreation-Includes COE Lake Cumberland Flood Control Project
Hoosier	Ohio-Louisville; Lower Ohio-Evansville; White	1,116	95	Recreation-Wildlife & Fish-Municipal - Includes COE Multi-purpose reservoir
Shawnee	Lower Ohio-Evansville	102	49	Recreation
	TOTALS	7,898	1,000	

Source: U. S. Forest Service

Table 32. Potentially feasible watershed projects - Structural measures 1/
(July 1, 1965 conditions)

Sub-basin	Number of Projects (No.)	Area in Potential Watersheds (Sq. Mi.)	Total Potential Structures (No.)	Area Above Structures (Sq. Mi.)	Total Storage Potential (Ac. Ft.)	Potential Surface Area (Acres)	Estimated Flood Channel Improvements (Miles)
Allegheny	19	3,746	112	885	565,461	18,720	19
Monongahela	18	1,896	148	622	279,423	9,995	10
Beaver	5	905	32	253	92,476	4,432	8
Muskingum	24	4,003	250	1,123	1,250,520	40,490	850
Little Kanawha	2	74	35	41	20,954	1,018	0
Hocking	4	313	27	88	69,076	2,215	95
Kanawha	32	2,312	155	975	502,728	10,998	35
Guyandotte	7	525	27	190	106,404	2,626	19
Big Sandy	20	1,463	82	582	303,616	10,121	41
Scioto	20	3,129	85	449	277,475	10,607	497
Little Miami	6	853	36	203	86,171	4,272	200
Great Miami	17	3,214	116	702	225,878	11,826	507
Licking	9	1,003	65	502	294,544	11,740	48
Kentucky	22	2,160	90	1,257	438,412	12,393	62
Salt	10	848	46	449	197,613	8,616	6
Green	45	3,431	192	1,311	804,963	35,202	296
Wabash	198	16,628	591	4,463	3,668,999	83,091	1,701
Cumberland	45	3,914	258	1,571	2,368,144	70,376	775
Ohio River Minor Tributaries	113	8,749	583	2,721	2,210,843	81,788	1,159
TOTAL	616	59,166	2,930	18,387	13,763,700	430,526	6,328

1/ Watershed projects that are potentially feasible for development under present P.L. 566 type criteria.

Source: SCS studies

Table 33. Structural data in upstream watersheds that do not appear to have project potential 1/

Sub-basin	Potential impoundment sites (No.)	Drainage area above impoundment sites (Sq. Mi.)	Average Drainage area above impoundment sites (Sq. Mi.)	Total storage potential (Ac. Ft.)	Potential surface area (Acres)	Average potential surface area (Acres)
Allegheny	204	1,531	7	960,150	32,083	157
Monongahela	213	1,004	5	417,027	18,651	88
Beaver	66	365	6	140,883	8,940	135
Muskingum	320	685	2	1,042,742	31,336	98
Little Kanawha	141	417	3	232,780	7,044	50
Hocking	67	109	2	227,878	5,979	89
Kanawha	462	3,743	8	2,048,432	48,378	105
Guyandotte	120	249	2	145,768	3,714	31
Big Sandy	66	278	4	140,390	3,165	48
Scioto	97	430	4	230,521	9,475	98
Little Miami	72	306	4	97,827	5,577	77
Great Miami	97	349	4	155,879	7,247	75
Licking	11	114	10	61,516	2,385	217
Kentucky	61	392	6	181,581	4,233	69
Salt	7	58	8	11,822	472	67
Green	53	310	6	341,684	10,058	190
Wabash	315	1,962	6	965,411	25,815	82
Cumberland	306	1,779	6	3,203,293	80,951	265
Ohio River Minor Tributaries	629	2,546	4	2,340,476	74,656	119
TOTAL	3,307	16,627	5	12,946,060	380,159	115

1/ Resource development potential in watersheds which do not appear to have project potential under present P.L. 566 type criteria.

Source: SCS studies

Table 34. Land Requirements, Ohio River Basin by Subareas, 1980

	Subarea	Total Land Area	Land Area Needed					Remaining Lands 1/
			Cropland	Pasture	Forest	Urban & Built-up	Subtotal	
		Thousand Acres						
A	Allegheny	7,486	489	216	4,367	369	5,441	2,045
B	Monongahela	4,127	204	229	2,359	163	2,955	1,172
C	Pittsburgh SMSA	1,946	102	119	610	397	1,228	718
D	Beaver	1,837	217	97	568	269	1,151	686
E	Upper Ohio	3,252	180	259	1,519	228	2,186	1,066
F	Muskingum	5,089	1,103	405	1,337	386	3,231	1,858
G	Kanawha-Little Kanawha	9,117	485	783	6,214	259	7,741	1,376
H	Ohio-Huntington	3,778	196	271	2,234	175	2,876	902
I	Scioto	3,979	1,882	415	646	253	3,196	783
J	Guyandotte-Big Sandy-Little Sandy	3,799	63	154	3,125	96	3,438	361
K	Ohio-Cincinnati	2,627	373	510	778	365	2,026	601
L	Little Miami-Great Miami	4,149	2,124	444	525	487	3,580	569
M	Licking-Kentucky-Salt	7,837	386	2,120	3,361	352	6,219	1,618
N	Ohio-Louisville	2,361	278	390	960	176	1,804	557
O	Lower Ohio-Evansville	4,759	1,578	393	1,438	189	3,598	1,161
P	Green	5,148	813	846	2,058	139	3,856	1,292
Q	White	8,625	3,470	725	1,937	638	6,770	1,855
R	Wabash	12,261	8,244	778	1,229	813	11,064	1,197
S	Cumberland	11,104	947	1,707	5,935	522	9,111	1,993
	TOTALS	103,281	23,134	10,861	41,200	6,276	81,471	21,810

1/ Includes: a. Land areas presently being used for farmsteads, rural non-farm residences, crossroad service stations, rural schools and churches, wastelands, etc.

b. Land areas that might be available for resource development (water and land) for recreation, fish and wildlife, flood prevention, municipal and industrial water supplies, irrigation, water quality control, etc.; without impacting crop, pasture, forest, and urban needs.

Table 35. Land Requirements, Ohio River Basin by Subareas, 2000

	Subarea	Total Land Area	Land Area Needed					Remaining Lands 1/
			Cropland	Pasture	Forest	Urban & Built-up	Subtotal	
		Thousand Acres						
A	Allegheny	7,486	560	421	4,400	476	5,857	1,629
B	Monongahela	4,127	272	530	2,377	208	3,387	740
C	Pittsburgh SMSA	1,946	138	284	613	457	1,492	454
D	Beaver	1,837	219	89	571	342	1,221	616
E	Upper Ohio	3,252	230	536	1,531	290	2,587	665
F	Muskingum	5,089	933	539	1,346	506	3,324	1,765
G	Kanawha-Little Kanawha	9,117	546	1,424	6,262	313	8,545	572
H	Ohio-Huntington	3,778	220	454	2,249	222	3,145	633
I	Scioto	3,979	1,921	315	652	398	3,286	693
J	Guyandotte-Big Sandy-Little Sandy	3,799	56	161	3,149	106	3,472	327
K	Ohio-Cincinnati	2,627	436	656	784	458	2,334	293
L	Little Miami-Great Miami	4,149	2,214	360	528	648	3,750	399
M	Licking-Kentucky-Salt	7,837	493	2,490	3,385	579	6,947	890
N	Ohio-Louisville	2,361	272	593	966	228	2,059	302
O	Lower Ohio-Evansville	4,759	1,691	893	1,447	211	4,242	517
P	Green	5,148	683	1,639	2,073	167	4,562	586
Q	White	8,625	3,060	1,142	1,952	863	7,017	1,608
R	Wabash	12,261	7,747	1,064	1,238	1,169	11,218	1,043
S	Cumberland	11,104	904	2,212	5,977	632	9,725	1,379
	TOTALS	103,281	22,595	15,802	41,500	8,273	88,170	15,111

1/ Includes: a. Land areas presently being used for farmsteads, rural non-farm residences, crossroad service stations, rural schools and churches, wasteland, etc.

b. Land areas that might be available for resource development (water and land) for recreation, fish and wildlife, flood prevention, municipal and industrial water supplies, irrigation, water quality control, etc.; without impacting crop, pasture, forest, and urban needs.

Table 36. Land Requirements, Ohio River Basin by Subareas, 2020

	Subarea	Total Land Area	Land Area Needed					Remaining Lands 1/
			Cropland	Pasture	Forest	Urban & Built-up	Subtotal	
		Thousand Acres						
A	Allegheny	7,486	557	527	4,455	551	6,090	1,396
B	Monongahela	4,127	280	732	2,407	240	3,659	468
C	Pittsburgh SMSA	1,946	161	493	618	499	1,771	175
D	Beaver	1,837	211	84	576	390	1,261	576
E	Upper Ohio	3,252	273	697	1,551	334	2,855	397
F	Muskingum	5,089	782	625	1,361	591	3,359	1,730
G	Kanawha-Little Kanawha	9,117	617	1,961	6,342	351	9,271	-(154)
H	Ohio-Huntington	3,778	221	534	2,274	255	3,284	494
I	Scioto	3,979	2,086	229	662	500	3,477	502
J	Guyandotte-Big Sandy-Little Sandy	3,799	54	320	3,189	114	3,677	122
K	Ohio-Cincinnati	2,627	403	781	794	523	2,501	126
L	Little Miami-Great Miami	4,149	2,372	219	533	761	3,885	264
M	Licking-Kentucky-Salt	7,837	639	2,868	3,425	738	7,670	167
N	Ohio-Louisville	2,361	263	647	976	265	2,151	210
O	Lower Ohio-Evansville	4,759	1,378	1,350	1,462	227	4,417	342
P	Green	5,148	651	1,932	2,098	186	4,867	281
Q	White	8,625	3,405	1,720	1,977	1,022	8,124	501
R	Wabash	12,261	7,087	1,700	1,253	1,419	11,459	802
S	Cumberland	11,104	885	2,898	6,047	709	10,539	565
	TOTALS	103,281	22,325	20,317	42,000	9,675	94,317	8,964

1/ Includes: a. Land areas presently being used for farmsteads, rural non-farm residences, crossroad service stations, rural schools and churches, wastelands, etc.

b. Land areas that might be available for resource development (water and land) for recreation, fish and wildlife, flood prevention, municipal and industrial water supplies, irrigation, water quality control, etc.; without impacting crop, pasture, forest, and urban needs.

Table 37. Projected area to be used for crop and pasture production, with probable water resource development, Ohio River Basin and subareas, 1980

Subarea	Crops				Pasture	Total
	Food	Feed	Roughage	Misc.		
	(Thousand Acres)					
A Allegheny	29	153	269	38	217	706
B Monongahela	13	71	63	57	229	433
C Pittsburgh SMSA	16	38	40	8	119	221
D Beaver	16	65	112	24	97	314
E Upper Ohio	28	68	64	20	259	439
F Muskingum	171	459	333	140	405	1,508
G Kanawha-Little Kanawha	13	230	138	104	783	1,268
H Ohio-Huntington	25	88	58	25	271	467
I Scioto	499	1,027	296	60	415	2,297
J Guyandotte-Big Sandy-Little Sandy	1	30	22	10	154	217
K Ohio-Cincinnati	169	121	59	24	510	883
L Little Miami-Great Miami	476	1,254	334	60	444	2,568
M Licking-Kentucky-Salt	35	154	141	56	2,120	2,506
N Ohio-Louisville	111	92	57	18	390	668
O Lower Ohio-Evansville	1,040	366	121	51	393	1,971
P Green	343	286	133	51	846	1,659
Q White	1,419	1,555	397	99	725	4,195
R Wabash	3,231	4,002	782	229	778	9,022
S Cumberland	244	388	234	81	1,707	2,654
TOTAL	7,879	10,447	3,653	1,155	10,862	33,996

SOURCE: ERS and SCS Studies

Table 38. Projected area to be used for crop and pasture production, with probable water resource development, Ohio River Basin and subareas, 2000

Subarea	Crops				Pasture	Total
	Food	Feed	Roughage	Misc.		
	(Thousand Acres)					
A Allegheny	34	273	217	36	421	981
B Monongahela	21	119	118	14	530	802
C Pittsburgh SMSA	15	59	57	7	284	422
D Beaver	8	124	64	23	89	308
E Upper Ohio	27	90	93	20	536	766
F Muskingum	216	352	226	139	539	1,472
G Kanawha-Little Kanawha	14	220	208	104	1,424	1,970
H Ohio-Huntington	24	87	85	24	454	674
I Scioto	950	736	178	57	315	2,236
J Guyandotte-Big Sandy-Little Sandy	1	19	27	9	161	217
K Ohio-Cincinnati	53	265	96	22	656	1,092
L Little Miami-Great Miami	1,026	909	222	57	360	2,574
M Licking-Kentucky-Salt	6	216	217	54	2,490	2,983
N Ohio-Louisville	56	121	78	17	593	865
O Lower Ohio-Evansville	944	534	163	50	893	2,584
P Green	74	293	267	49	1,639	2,322
Q White	1,570	1,363	25	102	1,142	4,202
R Wabash	2,911	4,035	590	211	1,064	8,811
S Cumberland	83	395	348	78	2,212	3,116
TOTAL	8,033	10,210	3,279	1,073	15,802	38,397

SOURCE: ERS and SCS Studies

Table 39. Projected area to be used for crop and pasture production, with probable water resource development, Ohio River Basin and subareas, 2020

Subarea	Crops				Pasture	Total
	Food	Feed	Roughage	Misc.		
	(Thousand Acres)					
A Allegheny	18	357	148	34	527	1,084
B Monongahela	29	156	81	14	732	1,012
C Pittsburgh SMSA	7	83	64	7	493	654
D Beaver	2	173	14	22	84	295
E Upper Ohio	15	126	113	19	697	970
F Muskingum	239	235	174	134	625	1,407
G Kanawha-Little Kanawha	21	222	271	103	1,961	2,578
H Ohio-Huntington	13	81	103	24	534	755
I Scioto	1,227	661	143	55	229	2,315
J Guyandotte-Big Sandy-Little Sandy	1	12	32	9	320	374
K Ohio-Cincinnati	8	340	34	21	781	1,184
L Little Miami-Great Miami	1,475	726	118	53	219	2,591
M Licking-Kentucky-Salt	1	295	292	51	2,868	3,507
N Ohio-Louisville	2	141	104	16	647	910
O Lower Ohio-Evansville	904	223	200	51	1,350	2,728
P Green	18	261	323	49	1,932	2,583
Q White	1,679	1,256	371	99	1,720	5,125
R Wabash	2,627	3,853	399	208	1,700	8,787
S Cumberland	17	355	436	77	2,898	3,783
TOTAL	8,303	9,556	3,420	1,046	20,317	42,642

SOURCE: ERS and SCS Studies

Table 40. Average annual flood damages in potentially feasible watershed projects
(July 1, 1965 conditions)

Sub-basin	DAMAGES							BENEFITS		Flood Plain Area
	Crop & Pasture	Other Agri.	Sediment & Erosion	Transportation Facilities	Urban	Indirect	Totals	Damage Reduction 1/	Other 2/	
	$	$	$	$	$	$	$	$	$	(acres)
	(Thousands of dollars)									
Allegheny	40	8	13	89	550	124	824	659	271	41,837
Monongahela	17	7	2	143	1,802	170	2,141	1,713	13	15,061
Beaver	5	2	0	93	154	24	278	222	96	8,560
Muskingum	1,047	178	21	161	717	212	2,336	1,869	1,110	118,589
Little Kanawha	10	13	0	45	113	5	186	149	0	984
Hocking	83	5	2	14	11	11	126	101	25	8,747
Kanawha	58	13	0	269	1,065	213	1,618	1,294	16	19,072
Guyandotte	22	0	0	134	523	84	763	610	50	7,116
Big Sandy	201	19	4	65	467	78	834	667	80	21,908
Scioto	971	76	19	24	353	144	1,587	1,270	234	76,387
Little Miami	229	19	5	4	51	31	339	271	168	19,482
Great Miami	957	63	12	132	471	157	1,792	1,434	341	76,213
Licking	399	32	7	24	97	56	615	492	343	28,959
Kentucky	338	34	8	39	130	54	603	482	310	33,349
Salt	168	14	2	4	20	21	229	183	142	13,429
Green	1,291	158	31	72	91	171	1,814	1,451	1,749	167,342
Wabash	10,557	356	62	196	24	1,092	12,287	9,830	3,844	679,726
Cumberland	1,364	181	200	380	560	447	3,132	2,506	1,731	113,923
Ohio River Minor Tributaries	3,757	240	38	387	1,901	570	6,893	5,514	4,276	425,784
TOTAL	21,514	1,418	426	2,275	9,100	3,664	38,397	30,717	14,799	1,876,468

1/ Damage reduction estimated at 80%.
2/ Includes productivity benefits due to restoration, intensification and change land use.

Source: SCS studies

Table 41. Conservation Treatment Needs for Cropland 1/

Subarea	Land on which the Dominant Problem is Erosion	Secondary Problem: None	Secondary Problem: Excess Water	Secondary Problem: Unfavorable Soil Conditions	Land on which the Dominant Problem is Excess Water	Secondary Problem: None	Secondary Problem: Erosion	Secondary Problem: Unfavorable Soil Conditions	Land on which the Dominant Problem is Unfavorable Soil Conditions	Secondary Problem: None	Secondary Problem: Erosion	Secondary Problem: Excess Water
					ACRES							
Allegheny	567,200	221,000	263,700	82,500	117,400	44,600	72,600	200	9,200	2,000	6,700	500
Monongahela	196,500	142,000	38,000	16,500	35,800	34,100	1,700	-	7,200	2,600	4,200	400
Pittsburg SMSA	252,500	140,200	91,700	20,600	13,400	9,000	4,400	-	2,300	-	2,000	300
Beaver	310,947	103,458	193,889	13,600	60,076	9,463	41,971	8,642	1,987	1,987	-	-
Upper Ohio	253,519	249,509	3,810	200	33,871	29,958	3,913	-	2,638	2,638	-	-
Muskingum	745,939	741,672	2,917	1,350	258,149	142,536	109,253	6,360	16,966	16,966	-	-
Kanawha-Little Kanawha	212,426	176,702	23,700	12,024	40,312	35,814	4,498	-	11,113	11,113	-	-
Ohio-Huntington	172,372	172,372	-	-	69,766	69,766	-	-	5,389	5,389	-	-
Scioto	504,822	504,459	363	-	1,077,002	664,221	399,574	13,207	12,263	12,263	-	-
Guyandotte-Big Sandy-Little Sandy	52,670	52,670	-	-	27,054	27,054	-	-	16,884	16,884	-	-
Ohio-Cincinnati	219,928	187,644	3,057	29,227	174,760	91,020	45,685	38,055	7,395	4,160	2,973	262
Little Miami-Great Miami	623,367	606,490	1,749	15,128	918,256	516,272	392,920	9,064	40,108	40,108	-	-
Licking-Kentucky-Salt	901,710	543,495	26,856	331,359	83,958	53,459	5,698	24,801	50,599	22,187	22,043	6,369
Ohio-Louisville	672,740	325,830	234,480	112,430	70,757	66,736	20	4,001	11,539	6,181	4,878	480
Lower Ohio-Evansville	456,860	223,340	54,120	179,400	478,879	343,570	500	134,809	31,001	15,181	5,873	9,947
Green	949,800	763,930	15,810	170,060	169,244	118,320	-	50,924	39,447	15,837	5,686	17,924
White	785,800	749,000	300	36,500	1,747,200	1,697,800	14,900	34,500	54,100	-	54,100	-
Wabash	1,643,800	909,100	554,100	180,600	3,015,300	2,416,900	33,000	565,400	253,100	-	253,100	-
Cumberland	1,245,112	774,337	180	500,595	145,053	104,600	-	40,453	35,277	9,682	17,840	7,755
TOTAL	10,768,012	7,557,208	1,508,731	1,702,073	8,536,237	6,475,189	1,130,632	930,416	608,506	185,176	379,393	42,937

1/ 1975 acreage exclusive of area not needing treatment or already satisfactorily treated
SOURCE: Soil and Water Conservation Needs Inventory

Table 42. Conservation Treatment Needs for Pasture Land and Woodland 1/

Subarea	PASTURE LAND						WOODLAND					
	Establishment or Reestablishment of Vegetation	Improvement of Vegetative Cover	Protection from Over-grazing	Protection from Erosion	Protection from Encroachment of Plants	Control of Excess Water	Establishment of Timber Stands	Improvement of Timber Stands	Protection from Fire	Protection from Insects & Disease	Protection from Animals	Erosion Control
Allegheny	155,500	172,100	9,400	2,300	24,700	106,700	408,600	734,900	206,000	285,000	74,000	101,000
Monongahela	139,200	28,300	57,200	12,700	24,300	26,600	196,800	772,600	798,700	-	312,700	35,900
Pittsburg SMSA	82,800	114,500	5,400	1,900	13,000	8,200	36,500	158,000	-	-	16,200	2,900
Beaver	64,088	60,108	3,425	300	7,300	58,496	65,861	156,394	-	-	30,186	2,500
Upper Ohio	144,461	238,287	46,590	3,200	21,548	18,465	226,503	886,878	626,700	-	520,031	6,700
Muskingum	317,200	412,718	27,590	-	45,095	66,478	216,147	667,118	-	-	494,297	-
Kanawha-Little Kanawha	222,120	610,492	195,865	24,900	90,800	81,400	370,538	3,500,600	5,141,395	857,136	1,053,200	52,100
Ohio-Huntington	128,060	215,713	24,511	5,053	33,855	30,662	271,209	801,788	1,122,702	228,001	538,465	27,241
Scioto	109,781	162,593	11,977	-	11,340	10,183	50,855	257,049	-	-	250,647	-
Guyandotte-Big Sandy-Little Sandy	126,701	86,439	27,050	6,923	13,879	10,307	471,326	1,505,330	3,186,196	1,013,898	336,684	73,757
Ohio-Cincinnati	175,892	170,598	55,585	10,218	36,203	14,358	78,908	171,699	321,277	286,032	285,143	18,166
Little Miami-Great Miami	140,078	149,188	33,229	9,900	18,879	22,726	34,224	133,085	33,700	72,700	188,408	1,500
Licking-Kentucky-Salt	593,026	8,755,345	186,353	31,492	81,282	40,832	589,653	1,771,791	3,335,129	1,383,941	667,835	186,792
Ohio-Louisville	151,364	140,143	61,280	44,735	21,090	7,834	103,695	378,739	842,487	672,367	343,586	46,267
Lower Ohio-Evansville	308,914	183,206	76,730	19,037	27,558	40,558	136,045	557,136	943,974	626,915	255,872	63,157
Green	328,892	312,062	94,290	11,200	26,767	26,424	279,889	1,054,285	1,828,449	1,125,716	421,428	91,780
White	312,600	164,200	104,900	56,400	34,600	8,800	140,300	725,500	1,589,200	1,526,000	475,000	32,200
Wabash	312,500	136,000	100,700	39,100	45,000	30,200	148,800	486,100	474,800	341,900	376,700	16,600
Cumberland	702,882	93,887	664,720	20,695	35,496	48,447	702,021	2,609,483	1,627,873	947,373	757,644	189,557
TOTAL	4,516,059	12,205,879	1,786,795	300,053	612,692	657,672	4,527,874	17,358,875	22,067,582	9,366,969	7,398,026	948,117

1/ 1975 acreage of Pasture and Woodland
SOURCE: Soil and Water Conservation Needs Inventory

Table 43. Demands for water and related land resources for recreation, and wildlife and fish in National Forests - present, 1980, 2000, and 2020

National Forest	Economic Sub-areas in which located	Present		1980		2000		2020	
		Water (Surface acres)	Related Land (Acres)	Water (Surface acres)	Related Land (Acres)	Water (Surface acres)	Related Land (Acres)	Water (Surface acres)	Related Land (Acres)
Allegheny	Allegheny	512 1/	173	8,100	1,700	10,600	2,100	10,600	2,100
Monongahela	Monongahela; Kanawha-Little Kanawha	1,100	380	5,000	1,300	8,500	2,200	11,000	2,700
Jefferson	Kanawha-Little Kanawha; Guyandotte-Big Sandy-Little Sandy; Licking-Kentucky-Salt	350	4,450	2,225	9,350	4,500	19,000	6,100	35,000
Cherokee	Kanawha-Little Kanawha	0	0	0	0	0	0	0	0
Pisgah	Kanawha-Little Kanawha	0	0	0	0	0	0	0	0
Yadkin Purchase Unit	Kanawha-Little Kanawha	0	0	0	0	0	0	0	0
Wayne	Upper Ohio; Muskingum; Ohio-Huntington; Scioto	1,700	450	7,400	2,450	17,000	3,050	19,500	3,650
Cumberland	Licking-Kentucky-Salt Cumberland	0 2/	1,000	0 2/	2,000	0 2/	3,000	0 2/	4,000
Hoosier	Ohio-Louisville; Lower Ohio-Evansville; White	1,400	1,050	2,800	1,850	8,100	2,500	13,000	3,100
Shawnee	Lower Ohio-Evansville	106	300	6,820	2,935	11,440	3,715	17,375	5,100
	TOTALS	5,168	7,803	32,345	21,585	60,140	35,565	77,575	55,650

1/ Includes Charman Dam State Park (67 acres) and Ridgeway Reservoir (67 acres) but does not include the Allegheny Reservoir

2/ The Cumberland National Forest indicates that they will have sufficient surface acres of water when present major reservoirs have been completed. There is little opportunity to develop small impoundments because of steep terrain on this Forest.

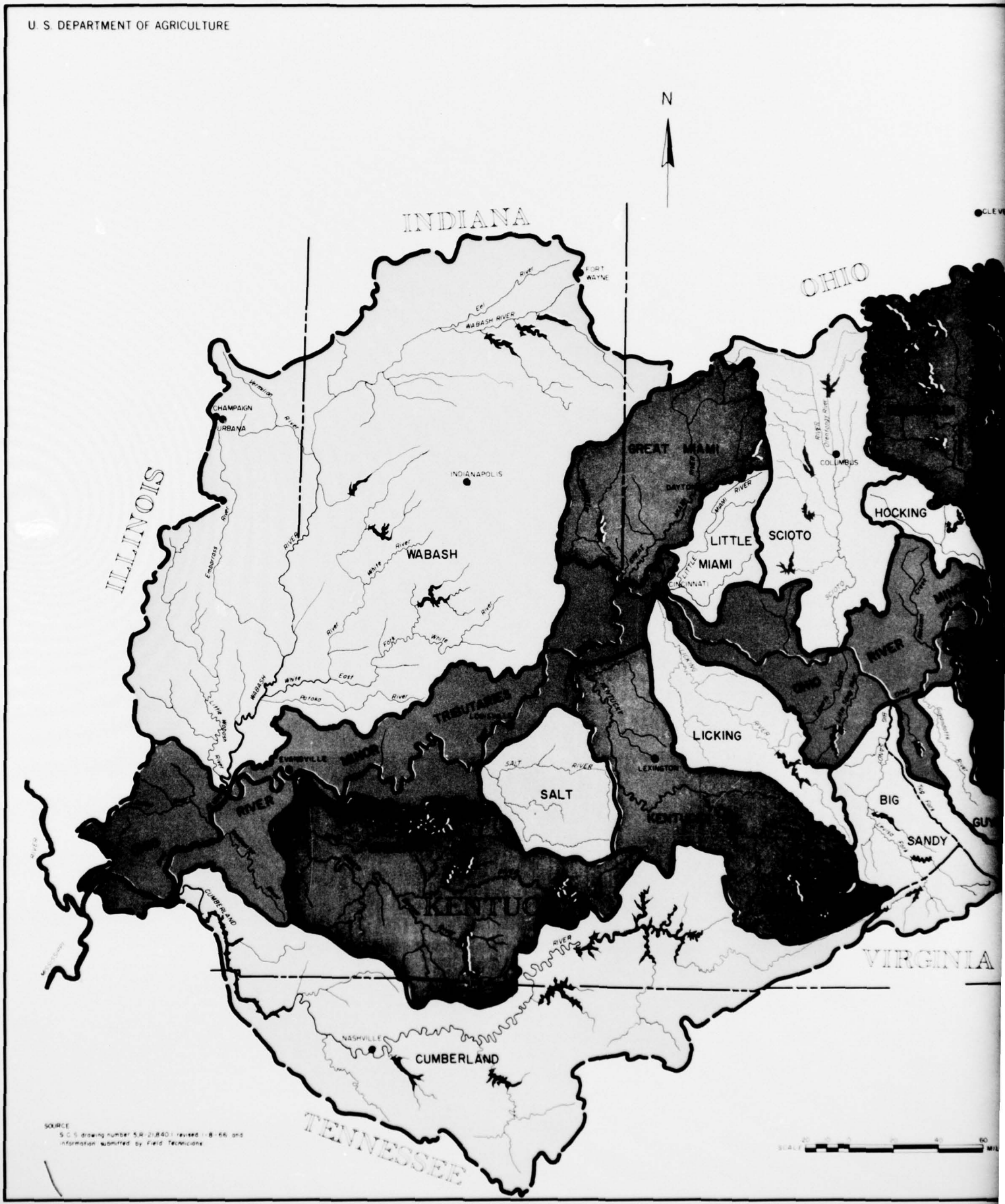
Source: U. S. Forest Service

Table 44. Potential watershed control relationship

Subbasin	Subbasin Drainage Area (Sq. Mi.)	Area in Potential Watersheds (Sq. Mi.)	Percent of Basin in Potential Watersheds (%)	Drainage Area Controlled by Potential Watershed Structures (Sq. Mi.)	Percent of Basin Controlled by Watershed Structures (%)
Allegheny	11,700	3,746	32.0	885	7.6
Monongahela	7,400	1,896	25.6	622	8.4
Beaver	3,130	905	28.8	253	8.1
Muskingum	8,040	4,003	50.0	1,123	14.0
Little Kanawha	2,320	74	3.2	41	1.7
Hocking	1,190	313	26.3	88	7.4
Kanawha	12,200	2,312	18.9	975	8.0
Guyandotte	1,670	525	31.4	190	11.3
Big Sandy	4,280	1,463	34.2	582	13.6
Scioto	6,510	3,129	46.2	449	6.9
Little Miami	1,760	853	48.4	203	11.5
Licking	3,670	1,003	27.3	502	13.6
Great Miami	5,400	3,214	59.4	702	13.0
Kentucky	6,970	2,160	31.0	1,257	18.0
Salt	2,890	848	29.3	449	15.5
Green	9,230	3,431	37.3	1,311	14.2
Wabash	33,100	16,628	50.2	4,463	13.5
Cumberland	17,920	3,914	21.8	1,571	8.8
Minor Tributaries	23,650	8,749	37.0	2,721	11.5
Total Ohio Basin	163,030	59,166	36.3	18,387	11.3

Source: SCS studies

U. S. DEPARTMENT OF AGRICULTURE



SOURCE
S.C.S. drawing number SA-21,840-1 revised 1-8-66 and information submitted by Field Technicians

SOIL CONSERVATION SERVICE

HYDROLOGIC SUB-BASINS

OHIO RIVER BASIN

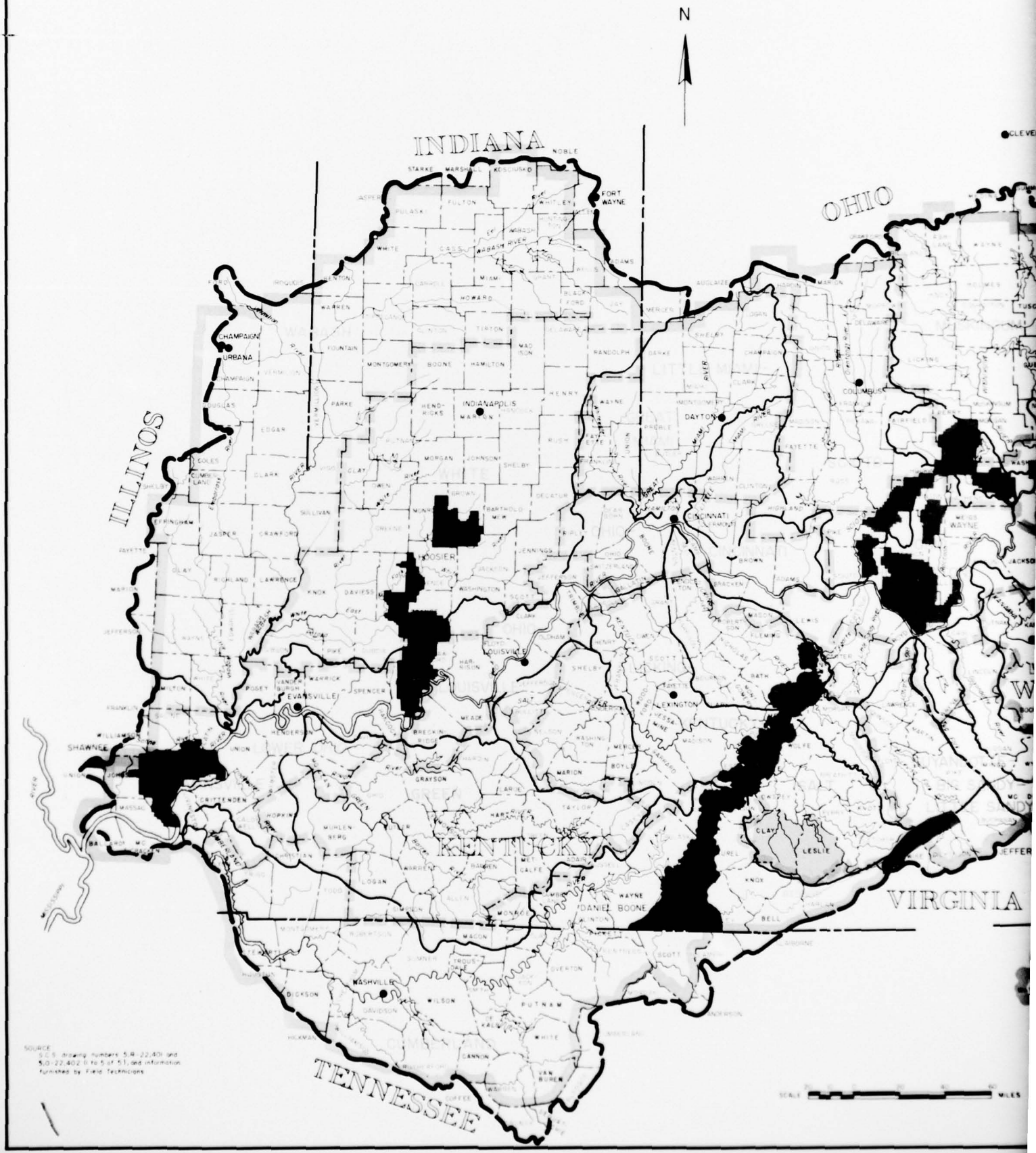
SCALE 20 0 0 20 40 60 MILES

REV. 9-16-66
REV. 5-24-66
REV. 5-10-66

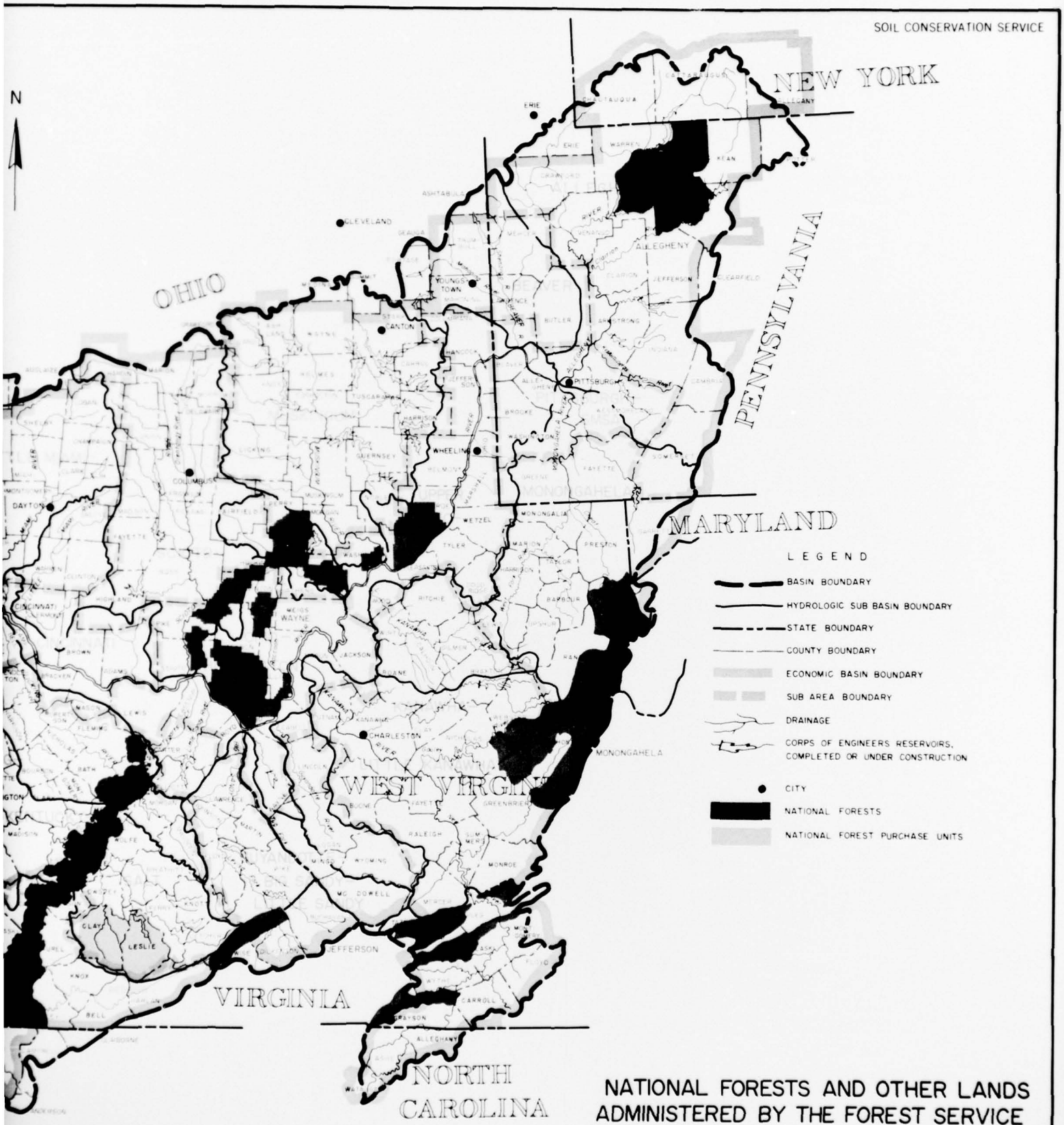
5,R-21,840.1

PLATE 1

U. S. DEPARTMENT OF AGRICULTURE



SOIL CONSERVATION SERVICE



NATIONAL FORESTS AND OTHER LANDS ADMINISTERED BY THE FOREST SERVICE

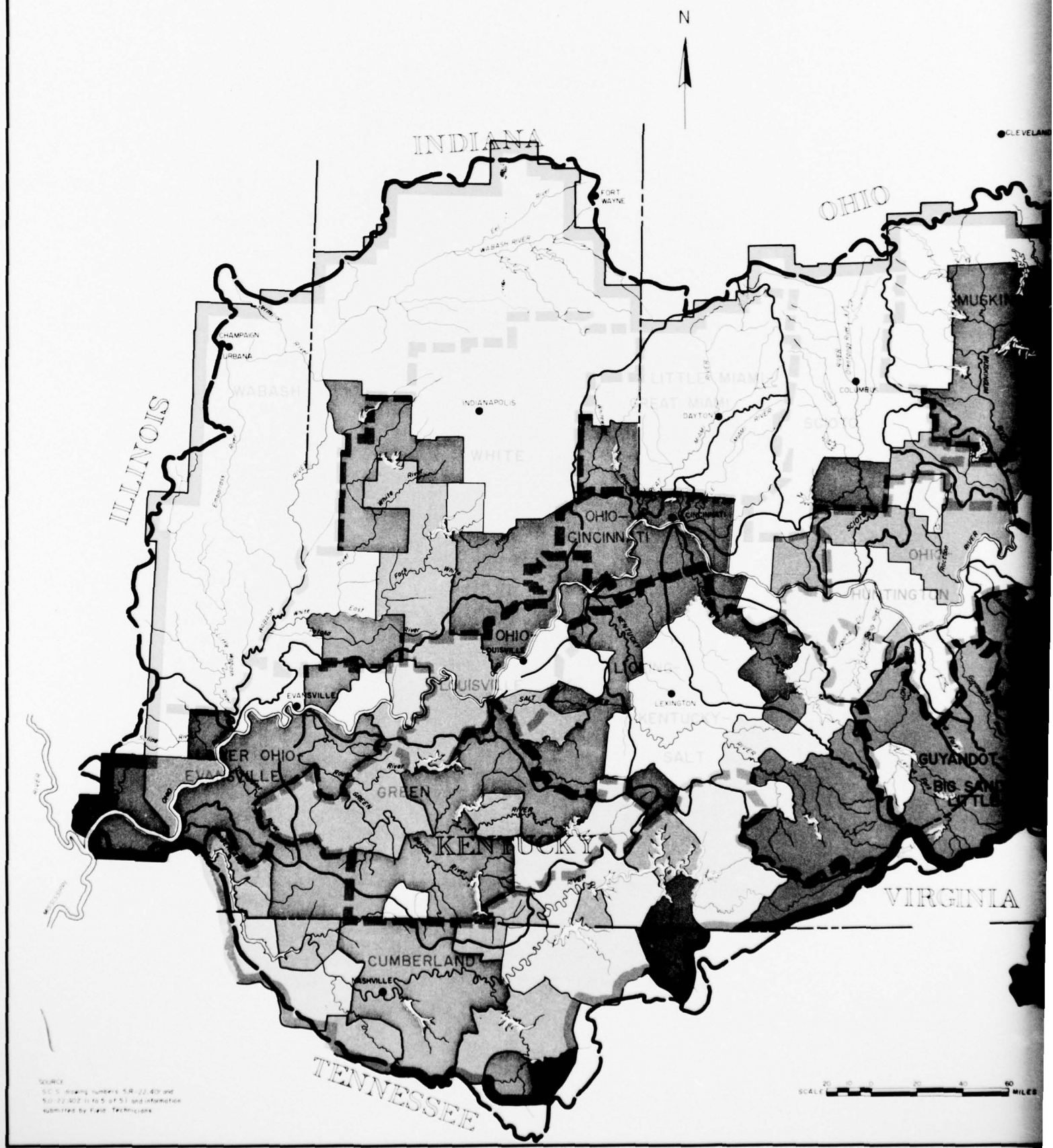
OHIO RIVER BASIN

REV. 9-15-66
REV. 5-26-66
4-25-66

S.R-22,705

PLATE 2

U. S. DEPARTMENT OF AGRICULTURE



SOURCE
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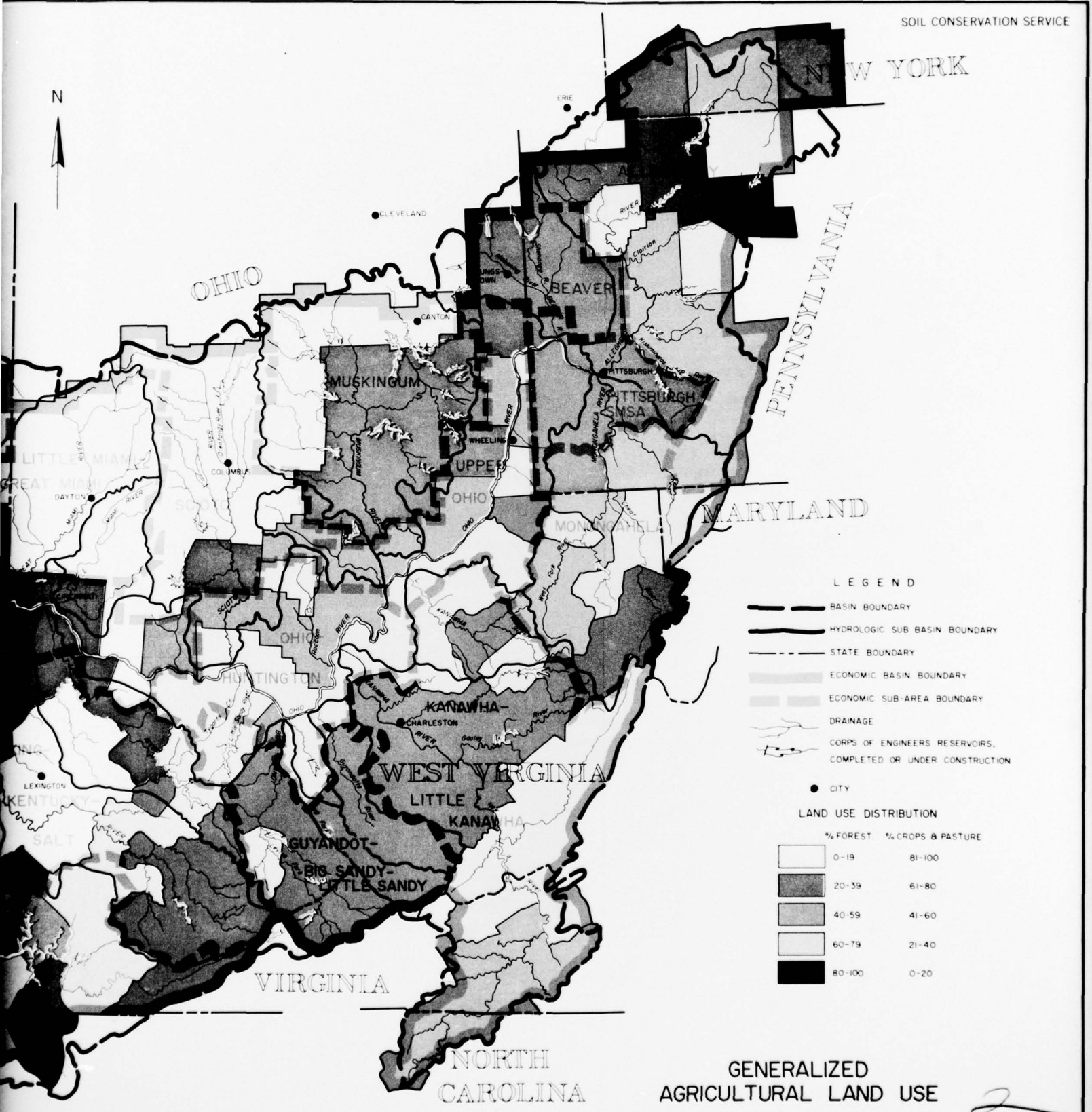
50-72 502 II to 5 of 51 and information
submitted by Field Technicians

SOIL CONSERVATION SERVICE

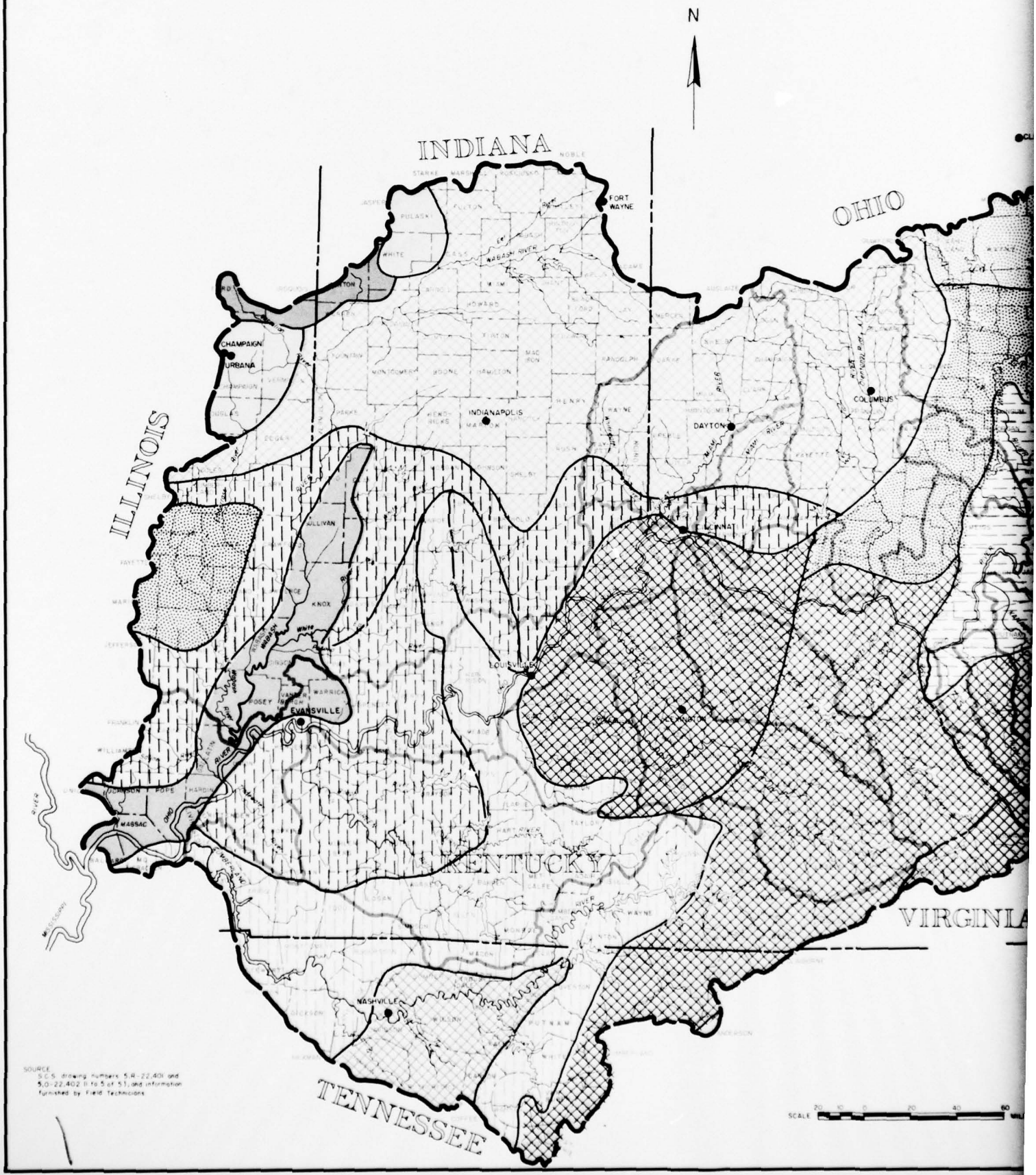


GENERALIZED AGRICULTURAL LAND USE
OHIO RIVER BASIN

REV 9-20-66
REV 5-26-66
4-29-66
5,R-22,706

PLATE 3

U. S. DEPARTMENT OF AGRICULTURE



SOURCE
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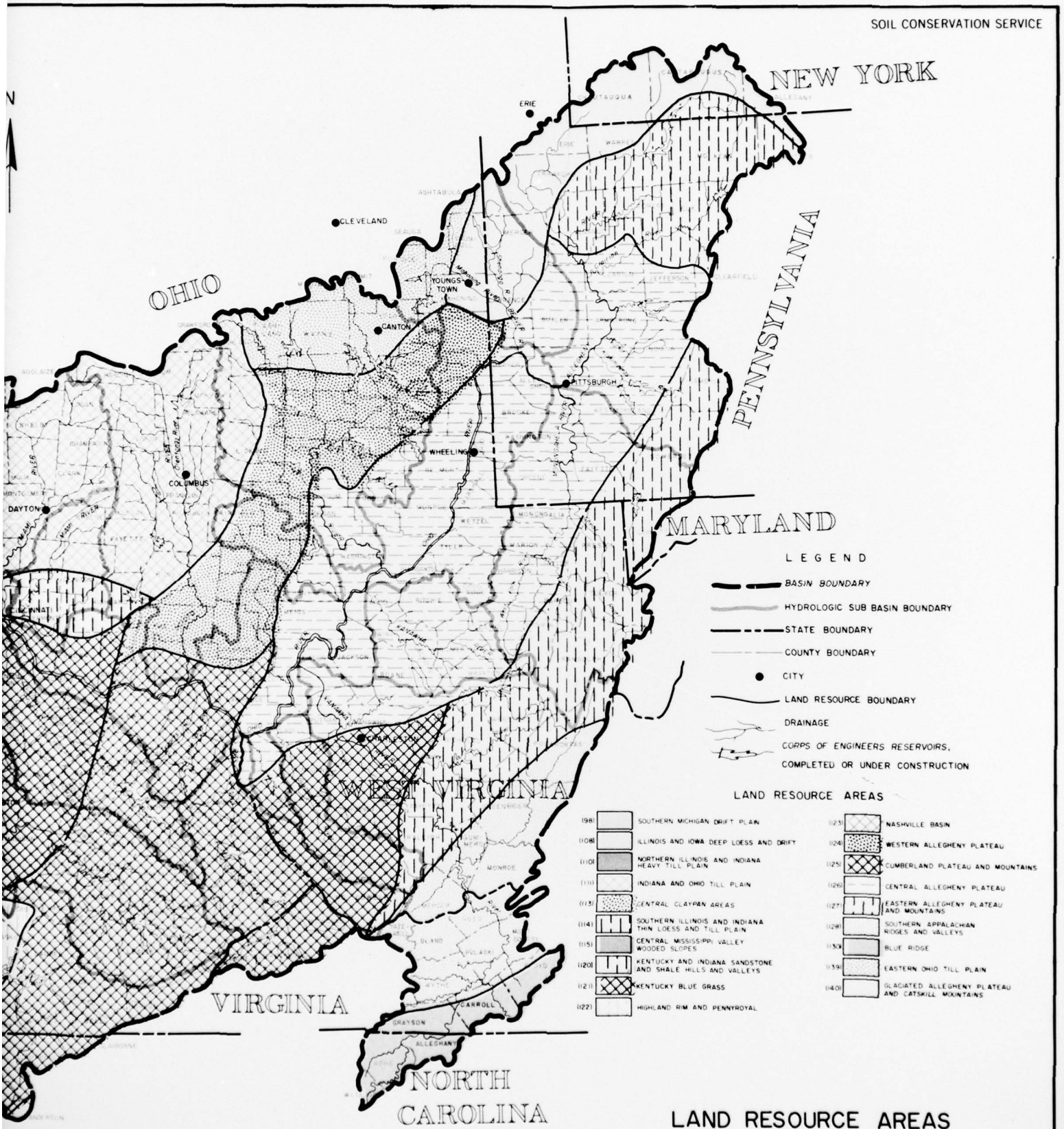
SOIL CONSERVATION SERVICE



LAND RESOURCE AREAS
OHIO RIVER BASIN

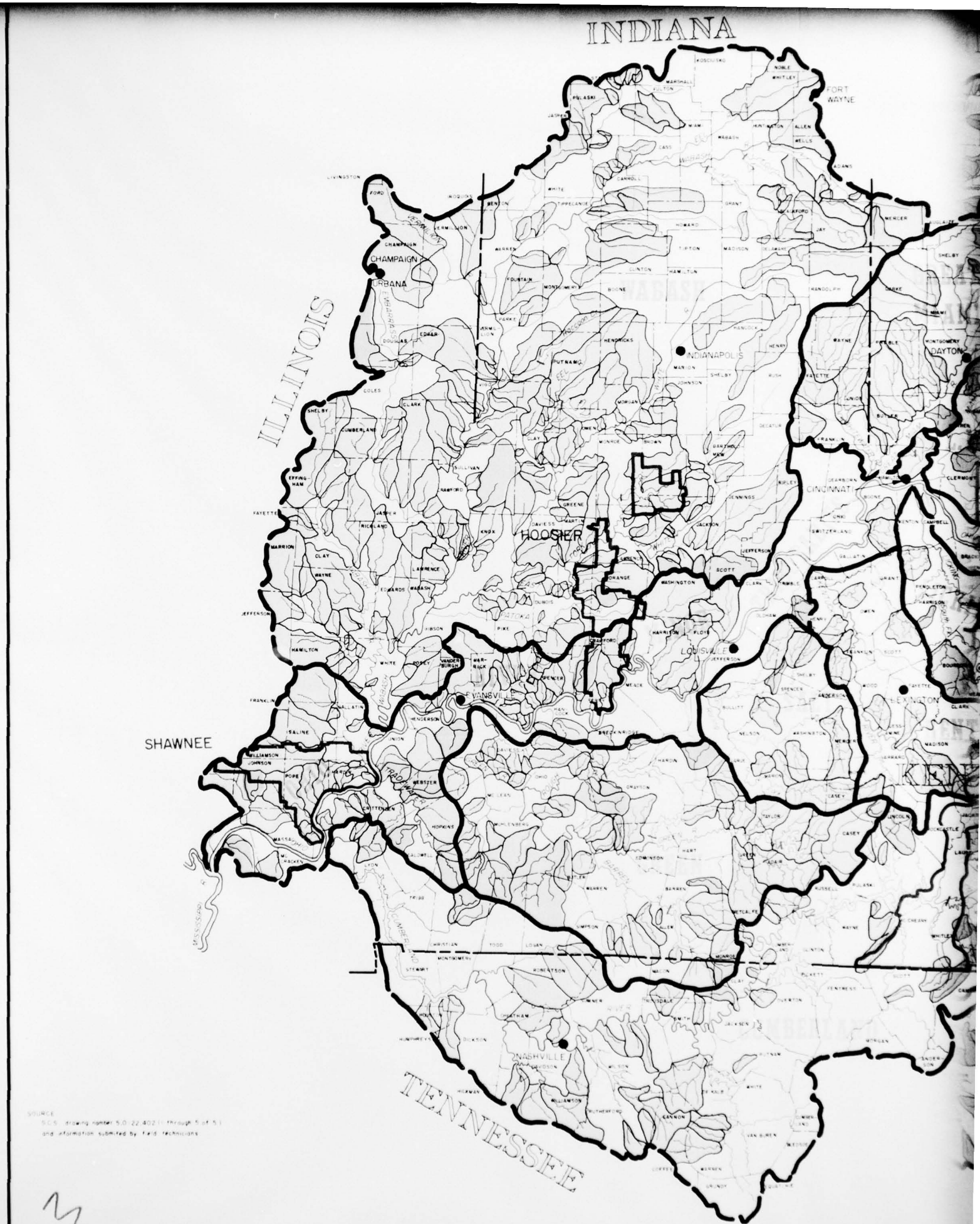
2

REV 9-21-66
REV 5-26-66
5-3-66
5,R-23,251

PLATE 4

U. S. DEPARTMENT OF AGRICULTURE

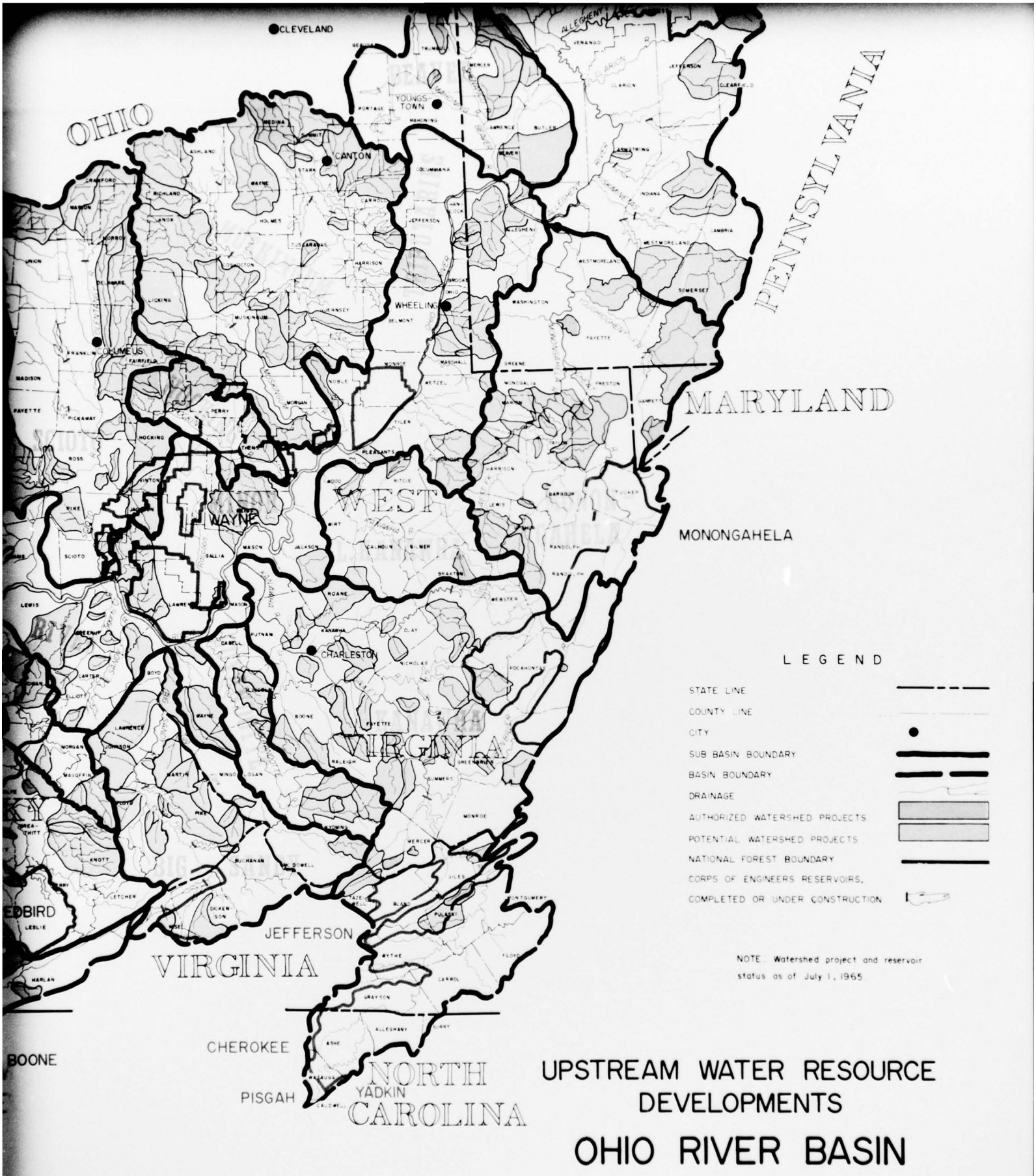

NEW YORK
SOIL CONSERVATION SERVICE
2
ERIE
CLEVELAND
ALLEGHENY
OHIO
YOUNGS-TOWN
CANTON
PENNSYLVANIA
WHEELING
COLUMBUS
MARYLAND
WAYNE
WEST
MONONGAHELA
CHARLESTON
VIRGINIA
JEFFERSON
VIRGINIA
LEGEND
STATE LINE
COUNTY LINE
CITY
SUB BASIN BOUNDARY
BASIN BOUNDARY
DRAINAGE
AUTHORIZED WATERSHED PROJECTS
POTENTIAL WATERSHED PROJECTS
NATIONAL FOREST BOUNDARY
CORPS OF ENGINEERS RESERVOIRS, COMPLETED OR UNDER CONSTRUCTION
NOTE: Watershed project and reservoir status as of July 1, 1965.



SOURCE
SCS drawing number 5-0-22.402(1) through 5 of 5)
and information submitted by field technicians

2


IANA
CLEVELAND
FORT WAYNE
OHIO
YOUNGS-TOWN
CANTON
INDIANAPOLIS
DAYTON
COLUMBUS
WHEELING
CINCINNATI
WAYNE
WEST
CHARLESTON
LOUISVILLE
LEXINGTON
VIRGINIA
KENTUCKY
REDBIRD
JEFFERSON
VIRGINIA
DANIEL BOONE
CHEROKEE
PISGAH
YADKIN
NORTH
CAROLINA
SCALE 20 10 0 20 40 60 MILES
UPSTREA
D
OHIO



UPSTREAM WATER RESOURCE DEVELOPMENTS

OHIO RIVER BASIN

REV. 9-22-66
REV. 5-25-66
4-21-66

5,R-23,252

PLATE 5